1934, No. 2 JULY 30

COPEIA

A JOURNAL OF COLD BLOODED VERTEBRATES

Established in 1913

PUBLISHED BY

THE AMERICAN SOCIETY OF ICHTHYOLOGISTS AND HERPETOLOGISTS

CONTENTS

Pseudo-melanosis in the Tail of Trout and Salmon

By R. F. Nigrelli

THE nature of the control of the movements of the granules in pigment cells of lower vertebrates has received considerable attention among biologists for a great number of years. Numerous investigators have supported the theory of a double innervation of the chromatophores, one system of nerves (parasympathetic) controlling the expansion, another (sympathetic) controlling the contraction of the pigment cells. Among the first to bring forth this view was Bert (1875), as a result of his investigations on the chameleon. Later, Carnot (1897) drew similar conclusions in regard to the amphibian chromatophores, basing his belief upon what he considered the separation by certain drugs of the action of two types of nerves which he called chromatodilators and chromatoconstrictors. Sollaud (1908) claims to have seen nerve fibers in actual connection with the chromatophores of the frog. However, Hogben (1924) and his collaborators have definitely shown that the pituitary secretion is the main factor in regulating the chromatic function in amphibia. He also believes that possibly adrenal secretion or some auxiliary mechanism plays a subsidiary part, but there are no satisfactory grounds for believing that nervous agencies directly influence amphibian melanophores, and there is no reason to believe that even if amphibian melanophores are directly innervated, nervous control is not significant to the normal rhythm of color change. Parker (1930), working on *Hyla versicolor* verified Hogben's findings. Redfield (1918) working on the horned toad, *Phrynosoma cornutum,* believed that contraction of the melanophores, in this form at least, is brought about by the cooperation of the nervous system and the secretion of the adrenal gland. Again, Hogben and Mirvish (1928) repeating experiments on the chameleon, concluded that the pigment cells are under direct control, since it was possible to evoke pallor by stimulation of the cord in isolated segments after the circulation had been cut off. According to these investigators, it is unlikely that adrenalin plays any significant part in the determination of excitement pallor as was suggested by Redfield's work on *Phrynosoma.*

Although many investigators have shown experimentally that hormonal substances can cause melanophores of fishes to react, there is no reason to believe that such substances play the important part. It has been definitely shown by many investigators that in these forms the chromatophores are under direct control of the autonomic nerves, with the stimuli acting through the visual organ. Up to date only one case has been definitely shown to be an exception to this generalization. Lundstrom and Bard (1932), in a paper devoted to the action of the pituitary secretion on the

color changes of the dogfish (*Mustelus canis*), showed very conclusively that hypophysectomy is followed by a permanent paling of the fish and that this paling can be changed into a temporary darkening by the injection of pituitary extract. It is further shown by these authors that the changes experimentally induced agree in general with those normally excited in this fish by alteration in the color of the background. Parker and Porter (1934) in experimenting on the same fish obtained results that verify the conclusion of Lundstrom and Bard. They found that the color changes in the dogfish are of two types, one from light to dark due to an expanding pituitary hormone carried from the gland to the melanophores by means of the blood and other body fluids, and another from dark to light due to a contracting local action of the nerves. It is interesting to note that the dogfish is the first one to be recorded in which cutting of nerves produces a paling. All other forms exhibit a darkening when their chromatophoral nerves are severed. These investigators believe that it is due to the fact that in the dogfish, unlike other fishes, probably only contracting nerves are present and that consequently in this fish these nerves have no others with which to compete as the contracting nerves of other fishes apparently have. On stimulation these nerves in the dogfish therefore assert themselves without hindrance. The dogfish is further peculiar in that it presents a melanophore system in which the expanding action is unihumoral like the amphibian, and the contracting action nerves like most other fishes.

In teleost fishes the question simmers down to whether the chromatophores have a single or double innervation. Lowe (1917) believed in single innervation in the brook trout (*Salvelinus fontinalis*). He reported that the contracted state is maintained by the activity of the sympathetic nerves; whereas expansion or relaxed state is caused by sympathetic inhibition. He regards these expansions as due to the cessation of the contracting stimuli. Spaeth and Barbour (1917), Wyman (1921), and Gilson (1926), after experimenting on the action of various drugs on the melanophores of *Fundulus,* claimed that their results showed nothing which could not be explained on the basis of the sympathetic fibers alone. They agreed with Redfield (1918) in the view that no one condition of the chromatophores could be regarded as the resting stage, but that contraction was controlled by central stimulation, and expansion by central inhibition by the sympathetic fibers.

Giersburg (1930) on *Phoxinus,* and Smith (1930) on *Fundulus,* showed that drugs that are stimulants and depressants have a definite effect on the nerves controlling the melanophores. The latter investigator reported that cocaine, which is a stimulant, did not expand the melanophores; ergot (depressant) produced the stellate condition; pilocarpine and physiostigmine (parasympathetic stimulants) contracted melanophores, and atropine (parasympathetic depressant) produced the stellate condition. Ergotized fibers react as if denervated, contracting in heat and expanding in cold; atropinized fibers react as if innervated, contracting in cold and expanding in heat. These results he believed to be suggestive of a double innervation of melanophores. Fries (1931) concluded that the melanophores and

xanthophores are under direct control of the nervous system, but humoral control under certain conditions supersedes and may normally re-enforce this neuron mode of regulation. Mills (1932a) after a series of experiments came to the conclusion that the fish melanophores are doubly innervated. Mills (1932a), in another paper, and Parker (1933) have brought forth evidence for a neurohumoral control of fish melanophores. In *Fundulus heteroclitus* denervated areas in the tail become light or dark by the expansion or contraction of the melanophores as the rest of the fish does but at much slower rates. These slow changes are believed to be due to neurohumoral materials secreted by the contracting or expanding nerve terminals and transmitted from the region where the terminals are active to those in which they have degenerated. The transmission is so slow that it cannot be attributed to blood and lymph. It is probably accomplished from cell to cell.

Results obtained from preliminary experiments on a pseudo-melanotic condition found in the tail of the Aquarium fishes do not substantiate this latest theory, nor do they substantiate any theory which considers the endocrine or other humoral substances as playing the major role in the melanophore reaction.

Trout and salmon hatched and reared in the New York Aquarium develop a peculiar condition in the tail regions which superficially appears as melanosis (Nigrelli, 1934). But microscopical examinations and comparative counts of pigment cells in an area 1 mm square, both in tails with this peculiar condition and in normal forms, show no differences as to size and number of cells. It has been concluded that the condition is one of more or less permanent paralysis of the nerves controlling the melanophores in these regions, so that these cells remain in the expanded or stellate state.

It has been found that about 25% of the fish that have been successfully reared develop this condition, which first makes its appearance in 5-6 month old fingerlings. In fully grown trout from one-fourth to one-half of the body is thus affected, the area extending from the tail fin forward, in extreme cases to the anterior border of the dorsal fin. In year old salmon it usually extends to midway between the caudal peduncle and the posterior border of the dorsal fin.

This peculiar condition is not necessarily bilateral in appearance. In a few fish it is unilateral; in others it appears as an isolated patch on either or both sides of the tail. Attempts to determine the cause for the expansion of the melanophores of the tail have so far been unsuccesful. Preliminary observations, however, have shown the following. (1) That an injection of a small dose of adrenalin (0.1 c.c.) or the application of the drug directly on the affected area causes a contraction. The injection of the adrenalin sub-peritoneally will bring on a differential reaction. That is, the melanophores of the trunk are the first to contract, followed by those of the head, finally the tail. As the effects wear off, the opposing reaction follows the same cycle. In the first stage of this cycle the head and tail regions are white in contrast to the black trunk. (2) Placing the fishes

with the black-tail in tanks with white background does not cause a contraction of these melanophores, but those of the head and trunk readily contract. (3) Placing them in tanks with black background causes all of the melanophores to relax but not to as great a degree as in the tail, for the black-tail could still be distinguished. (4) Prolonged stimulation of the cord, medulla or sympathetic nerve fibers causes a contraction of the abnormally expanded melanophores. (5) Too much stimulation produces a fatigue effect, resulting in the re-expansion of the melanophores. (6) In certain cases, when the electrical stimulus is applied in the brain region and cord, melanophores in various regions of the body and tail contract, while others remain expanded even in nearby areas. (7) All the melanophores contract on the death of the fish.

Therefore, it can be concluded that these abnormal melanophores of the tail behave as if denervated. To substantiate this conclusion it was found that such a black-tail condition could be experimentally produced if the sympathetic nerve fibers were severed. Employing Frisch's (1911) method, cuts were made at approximately the regions described for his experiments on *Phoxinus laevis* and *Salmo fario*. In one fish (salmon) with the black-tail, the sympathetic nerve fibers were cut at two levels on the right side of the body: one slightly posterior to the dorsal fin; the other anterior to it, but both along the lateral line. The melanophores in the middle third of the body (posterior to the cut) expanded, while those in the tail were still relaxed. When the fish died it was found that the melanophores on the left side of the body (including those expanded in the tail) immediately contracted, while those affected by the cuts on the right side remained expanded for some time after death. This would indicate, I believe, that although the melanophores in the trout and salmon with the black-tail react as if denervated, the nerves and nerve endings were still intact.

It also can be concluded that if hormonal substances or secretions played any part in the reaction, such as was stated by Wyman (1924), Gilson (1926) and others, the normal function of contraction and expansion would still occur in the presence of stimuli because the blood supply was found to be intact. If, on the other hand, it is a neurohumoral effect, as suggested by Mills (1932) and Parker (1933), the reaction should have occurred when the stimulus was present, for according to the latter investigator neurohumoral materials are secreted by the contracting and expanding nerve terminals and transmitted from the regions where the terminals are active to those in which they have degenerated.

At the time when this condition was first observed, we assumed that it was similar to that associated with what the German investigators called "Drehkrankheit" (staggers). This condition, which is also found in certain Salmonidae, is caused by a specific sporozoan parasite (*Lentospora cerebralis* Hofer-Plehn). The parasite primarily becomes localized in the cartilage cells of the organ of equilibrium. This sense organ is destroyed as a result of the infection, causing characteristic gyrations or "staggers." Eventually, amoeboid forms escape from the cartilage cells and wander

along the vertebral column to the tail region. A secondary infection occurs in which nodules are formed. These increase in size and impinge upon the sympathetic nerve fibers, interfering with the normal function, whereupon the melanophores remain in the expanded condition, resulting in a black-tail appearance. But in these forms the tail muscles atrophy and the fish finally die as a result of complications.

Autopsies of Aquarium fishes with the black-tail revealed no such infection, nodules, or any foreign bodies which might interfere with the normal function of the nerves in the tail region. The animals are normal in behavior and some of the adult trouts, weighing about three pounds, still show the condition.

Summary

1. Trout and salmon hatched and reared in the New York Aquarium develop a black-tail condition which superficially appears as melanosis.

2. It has been concluded that the condition is one of more or less permanent paralysis of the nerves controlling the melanophores in this region.

3. Attempts to determine the cause of black-tail have been as yet unsuccessful.

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A New Ceratiid Fish from the Gulf of Alaska

By LEONARD P. SCHULTZ

THE International Fisheries Commission collected a beautiful specimen of a little ceratiid fish in 1931 during the course of their investigations of the halibut fishery in the Gulf of Alaska. This specimen we believe to represent a new species, which we take pleasure in naming *Dolopichthys thompsoni* in honor of Dr. W. F. Thompson, Director of the International Fisheries Commission, and Chairman of the Department of Fisheries, University of Washington, Seattle.

Dolopichthys ***thompsoni***, new species

Holotype.—A 32 mm. specimen, collected in a 2 meter Danish ring trawl hauled from a depth of 900 to 100 meters, at 54° 13′ N., and 159° 06′ W., on July 3, 1931. The holotype, the only specimen known, is deposited in the collection of fishes, Department of Fisheries, University of Washington, Cat. No. 2530. The following measurements are recorded in hundredths of the standard length: Length of maxillary (from articulation) 35; greatest depth of body 65; length of head 58; least interorbital width 13; distance between supraorbital spines 30; length of gill slit 16; basal joint of rostral spine 10; terminal joint of rostral spine 26; distance from tip of snout to dorsal 88; distance from tip of snout to anal 80.

The following counts were made: Anal rays 4; dorsal rays 5; caudal rays 8; pectoral rays 15.

Color, jet black.

Dolopichthys thompsoni differs so much from all other described ceratiids, with the exception of *D. acanthias* (Gilbert), that it could not be confused with them. Since Parr (Bull. Bingham Oceanographic Collection, 3 (1), 1927: 1-34, 13 figs.) and others have described and used the tentacles or "bait" of the illicium of various ceratiids for the separation of

species, the author believes that although a series of specimens is lacking of both *thompsoni* and *acanthias* from which the amount of variation may be determined, the naming of our specimen as a new species, based largely on the structure of the illicium, is justified.

The chief differences between *thompsoni* and *acanthias* are to be found in the structure of the bulbs. Gilbert states that the bulb on his type "is laterally compressed, provided anteriorly with a lappet or cirrus and posteriorly with a short fleshy process" (Figures 1 and 2). The bulb of *thompsoni* has two tentacles along the mid-line; the anterior one is slender and without finger-like projections, it arises distally just above the pigmented

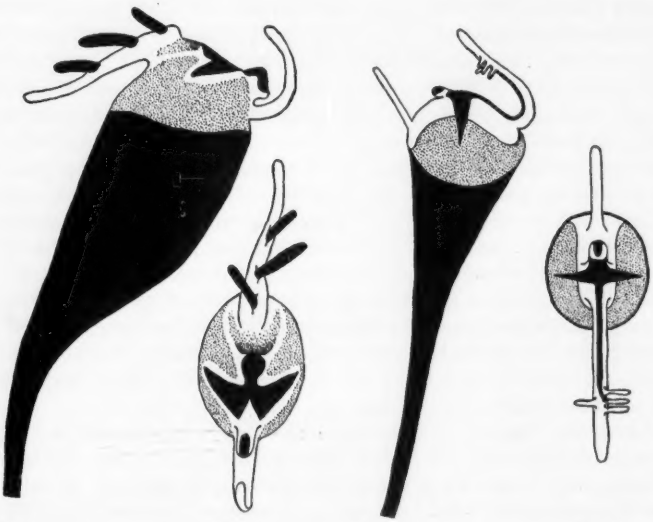

Fig. 1 Fig. 2 Fig. 3 Fig. 4

Fig. 1. View of the left side of bulb of the illicium of *Dolopichthys acanthias* (Gilbert). After a free hand sketch of the type by Dr. Carl L. Hubbs.
Fig. 2. Dorsal aspect of bulb of Fig. 1.
Fig. 3. View of left side of the bulb of the illicium of *Dolopichthys thompsoni* Schultz.
Fig. 4. Dorsal aspect of bulb of Fig. 3. Note that the anterior and posterior tentacles are reversed between *acanthias* and *thompsoni*.

area. The posterior tentacle which is heavier and broader arises slightly above the pigmented area, and has near its distal end a group of 4 non-pigmented filamentous projections or cirri not arranged serially (Figures 3 and 4). The anterior tentacle in *acanthias* has three jet black filaments arranged serially, figures 1 and 2. In *thompsoni* a little rounded elevation occurs just posterior to the base of the anterior tentacle. This body is pigmented only at its tip. On the posterior base of this rounded elevation there is a dense pigmentation which immediately expands laterally into

short wings, resembling in shape those of birds, while mesially the pigmentation continues as a narrow band extending along the mid-line of the bulb and terminates in the posterior tentacle about a third of the length from the tip, near the group of filamentous projections. In *acanthias* the lateral wings of pigment are similar but the narrow band does not extend along the anterior tentacle.

It is possible that one or the other of the bulbs of the two forms have been mechanically turned around in preservation although this is not evident from the material.

D. thompsoni has 18 teeth on the dentary, instead of 13 to 15 as reported by Gilbert for *D. acanthias* (Dr. Carl L. Hubbs, however, in reexamining Gilbert's type finds 15 or 16 teeth).

D. thompsoni is placed in the genus *Dolopichthys* because Regan (The Danish "Dana" Expeditions 1920-1922, Oceanographical Reports, 1926, No. 2: 1–45, pls. I–XII), in revising the Ceratioidae synonymized Gilbert's *Monoceratias* with Garman's genus *Dolopichthys,* which is referred to the family Oneirodidae. The latter genus is defined by Regan (*l.c.,* 1926: 27) in his species diagnosis as having the "articular spines well developed, that of the quadrate longer than the mandibular." The new species agrees perfectly with his description of the articular spines. Since *D. acanthias* is so similar to *D. thompsoni* it is concluded that Regan's doubt as to the size and relative strength of the articular spines in *acanthias* may be removed. Gilbert (*l.c.,* 1915: 379) placed his genus *Monoceratias* close to *Diceratias,* but Regan placed the latter in the Himantolophidae, the members of which have two pectoral radials instead of 3 as in the Oneirodidae. We find in *thompsoni* 3 well developed pectoral radials, which corroborates Regan's classification of *acanthias.*

Among the characters which Regan uses to define the family, is "caudal of 9 rays, 4 bifid and 2 above and 3 below," but the number of branched and simple rays as shown in the figures given by Regan vary as follows: *Oneirodes eschrichtii,* 2-4-2 (2 simple rays above, 4 branched, and 2 simple rays below); *Dolopichthys luetkeni,* 2-4-3; *D. heteracanthus,* 2-4-3; *D. danae,* 2-4-2; *D. gracilispinis,* 2-4-3; *Lophodolus acanthognathus,* 2-4-3; *Chaenophryne longiceps,* 2-4-3; *Lasiognathus saccostoma,* 2-4-2; Gilbert's 1915 figure of *D. acanthias* shows 1-6-1 (but Hubbs in re-examining the type finds 2-4-3). The new species has 2-4-1-1, the lowest ray being branched. In other families we note that the number of rays are 1 or 2-4 to 6–2 or 3. Thus we believe the number of simple and branched rays is so variable that it renders the character useless for a family characteristic, and of doubtful value even as a specific character in most ceratiids.

It appears that the genus *Dolopichthys* has a wide distribution in the North Pacific Ocean, since Gilbert's specimen was taken off Santa Cruz Island, California, at a depth of 764 to 891 fathoms and this new species at a depth of about 450 to 50 fathoms in the Gulf of Alaska.

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Cercaria bessiae Cort and Brooks, 1928, an Injurious Parasite of Fish

By WENDELL H. KRULL

SINCE the publication by the writer (Krull, 1932) of a paper in which it was stated that *Cercaria bessiae* Cort and Brooks, 1928, developed into *Neascus ambloplitis* Hughes, 1927, in a fish, *Eupomotis gibbosus* (Linnaeus), repeated experiments with this fish indicate that it may be affected by the parasite in different ways. These results are presented in an attempt to show what possible effects, direct or indirect, the parasite may have on fish in nature. The final host of this parasite is not known; feeding experiments carried out by Hunter and Hunter (1930) indicate that the parasite may be a species of *Crassiphiala* which matures in the kingfisher, *Ceryle alcyon* Linnaeus. The importance of the fluke and of any information concerning its life history or that of any closely related form is evident in view of the following observations.

In 1931, the writer, while connected with the Institute for Fisheries Research, University of Michigan, had an opportunity to conduct an investigation of some brook trout ponds on the Sturgeon River, near Vanderbilt, Michigan. The ponds were formed in series by damming the river. Some of the changes resulting from this damming were widening and deepening of the river, inundation of much fallen timber, a gradual increase in depth along the shore, slackening of the current and increase in temperature of the water. These changes, apparently, increased the amount of food and improved conditions for survival of snails, of which there were countless numbers. The brook trout, *Salvelinus fontinalis* (Mitchill) in these ponds, both large and small, had black spots in the skin which on examination at Ann Arbor, Michigan, proved to be cysts containing a *Neascus,* tentatively identified as *N. ambloplitis* Hughes. Only a limited amount of material was available for examination, and since most of the cysts were degenerating at the time the infected fish were collected in June no final determination could be made. Incidentally it may be said that kingfishers, suspected of being the primary host, were numerous in the region where the trout were collected.

On the basis of laboratory experiments with *Cercaria bessiae,* it may be assumed that under natural conditions the cercaria is responsible for the deaths of many small fish fry. Repeated infection experiments with fish, *Eupomotis gibbosus,* have been carried out for one year, and it has been found that there is more or less uniformity in the effects of the parasites on the host, the effects depending on the size of the fish. The fish may be divided roughly into 3 groups on this basis as follows: Small fish, 15 mm. to 30 mm. in length (tip of snout to base of caudal fin), when subjected to cercariae in large numbers succumb to the effects produced by them;

larger fish rarely succumb even to repeated exposure; and large adults are more or less free from the effects of penetration except for the reactions of the fish at the time of exposure.

Fish of all sizes respond to the penetration of the cercariae immediately and in a very characteristic way. They are stimulated to activity and go through the water by spurts in all directions. Soon after the initial attack they attempt to detach the cercariae by rubbing against the bottom and sides of the aquarium or against objects in the aquarium. This activity subsides gradually, being replaced by a flexing of the body while suspended in the water, the flexion of the body to either side being extensive, this position being held for several seconds before relaxing. Besides this reaction some of the fish shake themselves violently without translatory movement, and raise the opercula. Activity subsides in about 15 minutes and the exhausted fish collect in some particular spot near the surface of the water, remaining motionless for an hour or more except for profound respiratory movements, before resuming their normal activity. The symptoms are very similar to the ones described by Blochmann (1910) for fish which were subjected to *Cercaria fissicauda.*

Cercariae used in the infections were obtained from an individual snail already reported by Krull (1932), which has shed cercariae daily for more than a year. Fingerbowls or battery jars were used in subjecting fish to infection, the type of container depending on the number and size of the fish to be infected. Larger containers were not satisfactory for infection experiments since it was found that if the light was not uniform the fish remained on the darker side of the container while the cercariae, exhibiting positive phototropism, collected on the side where the light was more intense, and, consequently, the fish acquired very few or no cysts.

The smallest fish used did not succumb immediately to the attack of the parasite, even when subjected to thousands of the cercariae in a very small amount of water, but they died within 2 to 4 days, 3 days being the average, after being subjected to infection. The fish rarely showed any symptoms of infection or symptoms of secondary disease conditions. Hemorrhagic areas or spots were seen occasionally on the body and at the bases of the fins. Many of the parasites were still wandering in the myotomes of the fish which died on the third day after infection, although some parasites had become encysted. Heavy infestations may be developed in very small fish by subjecting them periodically to a few cercariae, but much care must be taken in order that the number of cercariae to which the fish is exposed each time be not too great. The fish may die from the effects of penetration of the cercariae or from the effects of their growth. It is possible for the smaller fish to acquire a sufficient number of developing cysts in the myotomes to produce permanent flexions in the body or to produce stiffness which renders the fish incapable of swimming. Arrested development, particularly of the head, was observed in small fish which were heavily infested. This abnormality and other abnormalities of small fish affected by parasitic infestations have been observed and adequately described by Hubbs (1927).

As previously stated, the larger fish rarely succumb to the infection

when subjected to large doses of cercariae, and enormous infestations may be built up, as shown, for example, in figures 1 and 2, by subjecting the fish repeatedly, even daily, to cercariae. The fish, 55 mm. long, shown in the figures was subjected to thousands of cercariae on October 5, 11, 17, and 18, 1932. Some of the cysts which resulted from the infection were pigmented by November 5, but many were still unpigmented at the time the fish died, February 11, 1933. The photographs of the fish were made a month prior to its death and many bunches of partially pigmented cysts developed along the back, the opercula, and the bases of all fins subsequent to that time, so that while the photographs show an enormous number of cysts a month before death, the actual number at the time of death was much greater.

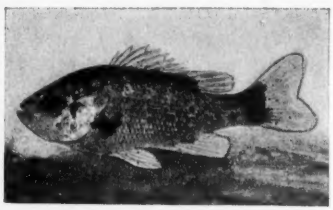

Fig. 1. *Eupomotis gibbosus* experimentally infected with *Neascus ambloplitis.*

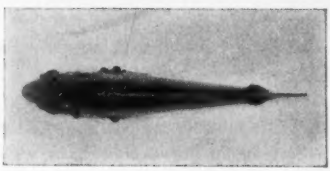

Fig. 2. Same fish, dorsal view.

The death of this fish was not due to infestation but, apparently, was due to fright, and this phenomenon has been observed many times in uninfested as well as infested fish. Fish becoming so affected make a dash through the water, then become rigid, turning ventral side up, with the opercula raised and the mouth open and fixed. Some of the affected fish recover, and when this occurs the mouth usually remains open until all other symptoms have disappeared.

The enormous infestation described above could not be obtained in the largest pumpkinseeds, even though the same responses to infection were produced at the time the fish were subjected to the cercariae. One fish 125 mm. long was subjected to thousands of cercariae on 11 different days, and when examined 3 months after the last infection date only 4 cysts were recovered from the fins and 35 from the muscles.

The sunfish, *Apomotis cyanellus* (Rafinesque), a fish not previously known to serve as an intermediate host, was also experimentally infected with *Cercaria bessiae.* Mud minnows and goldfish could not be infected.

The position of the cysts varied in fish of the same species. Hughes (1927) found *Neascus ambloplitis* in the myotomes, integument, bases of fins, around the eyes, in the mouth, under the surface of the head, and, in only a very few cases, in the peritoneum. The writer has taken them from all these places except the peritoneum. In experimental infections the parasites may concentrate in various parts of the body of the host. In some fish, most of the cysts have been found in the myotomes of the back;

in one fish most of them were at the base of the tail; and in still another fish most of the cysts were in the fins. A very profound "popeye" condition developed in 3 fish and, no doubt, was the cause of death in two of them. Several other fish developed the condition to a lesser extent (Fig. 2). The condition was most serious in small fish, those 30 mm. or less in length. In one fish 28 mm. long, the head was attacked by the cercariae, and when the cysts developed they were so numerous in the lower jaw that the fish was unable to eat and died of starvation. This fish also had a very serious "popeye" condition, and 136 cysts, each about 500μ long and not fully developed, were removed from the orbit of one eye. A similar "popeye" condition has been described in the fry of the black spotted trout by Ward and Mueller (1926), and attributed by them to *Distomulum oregonensis* Ward and Mueller (1926), which, according to Price (1929), is the metacercaria of *Nanophyetus salmincola* (Chapin, 1926) (= *Troglotrema salmincola* (Chapin).

In the two sunfish, *Apomotis cyanellus,* which were infected, the parasites were confined to the fins.

The writer has been trying to secure data on the length of life of the parasite and its disposition in the second intermediate host, but to date it has been impossible to keep infested fish for more than 4 months, although quite a number have lived for this length of time without the cysts showing any evidence of degeneration. While it cannot be definitely stated that the parasites in these cases are responsible for death, there are indications that the infestation may be a contributing factor, if not a direct cause of death.

Summary

Experiments show that *Cercaria bessiae* may be a cause of deaths of many fish fry. The damage done may be correlated with the fact that cercaria production is high as indicated by one case of an infected snail which has shed cercariae daily for more than a year in the laboratory. In experimental infections of the fish *Eupomotis gibbosus* with *Cercaria bessiae,* small fry usually die 3 days after being subjected to large numbers of the cercariae. Enormous infestations may be built up in small and medium sized fish. Medium sized fish usually are not killed even when subjected to large numbers of cercariae daily. In large adults very few cysts develop even when the fish are exposed repeatedly to large numbers of cercariae. Fish show a marked response to the attack by the cercariae. Cysts may be concentrated in various locations, including the eye, and the parasite may cause the condition known as "popeye". The sunfish, *Apomotis cyanellus,* is reported as a new second intermediate host for *Neascus ambloplitis.*

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Antillean Tortoises and Terrapins: Distribution, Status, and Habits of *Testudo* and *Pseudemys*

By CHAPMAN GRANT and C. RALPH DE SOLA

INTRODUCTION

THAT tortoises, *Testudo*, are found in the Greater Antilles is well known except to a few recent herpetologists who omit mention of them in their papers on the West Indian fauna. The senior author, however, has recorded their presence in two of the Virgin Islands, the junior author has seen feral specimens in Cuba and Jamaica, and Mr. William G. Hassler of the American Museum of Natural History recently reported them from Santo Domingo.

Concerning the terrapins, *Pseudemys*, which are found in the Greater Antilles; the eastern limit of their distribution seems to be Vieques Island, Puerto Rico, (Grant, 1932), and from observations made by the junior author on a series of specimens collected in Cuba by Mr. Arthur M. Greenhall (De Sola and Greenhall, 1932), from Lake Rincón, Province of Barahona, Santo Domingo, by Mr. William G. Hassler, and from Puerto Rico

by the senior author, it is evident that they separate into two distinct species, i.e., *Pseudemys rugosa* and *P. decussata.* To complete their coextensive Antillean distribution, Jamaica remains to be accounted for. Nevertheless, earlier works listed both forms from that island and recent authorities have spoken about noticing separations in specimens from that island. We think it is very likely that the same two species will be found there.

In the rest of the paper we will attempt to give a taxonomic review of the West Indian tortoises and terrapins, here and there adding a few notes and, finally, for the sake of brevity, referring our readers to the annotated bibliography.

Testudo denticulata Linnaeus

Walbaum's tortoise or *Morrocollo*

Testudo denticulata Linnaeus, Syst. Nat., 1, 1766: 352.
Testudo tabulata Walbaum, Chelonogr., 1782: 122.
Testudo denticulata Stejneger, Proc. U.S. Nat. Mus., 24, 1902: 192.
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Reported in West Indies from Cuba, Jamaica, Hispaniola, Puerto Rico, St. Thomas, St. John, and Guadeloupe.

Recent herpetological works of the Antilles either fail to mention *Testudo* or include it as an introduced species. However, it seems unreasonable to imagine that precolumbian Indians would have introduced valueless tortoises. There is every reason to believe that they would *not* introduce them because: (1) tortoises were not worshipped or venerated; (2) they were not represented in petrographs or pottery so far as known; (3) they were not eaten, because the Indians thought that the sloth of the tortoise would pass to him who ate it.

The fact that both tortoises and iguanas occurred on the Antilles as early as 1658 leads us to believe that they are endemic. *Cyclura,* the large ground iguanas, are used today as food on Mona Island and elsewhere and they are accepted as endemic forms because their bones are found in caves. The tortoise, living in the open, left no fossils and its bones should not be expected in kitchen middens since it was probably not used for food. The tortoise gives us the best evidence of endemism since it still occurs alive and feral in Cuba, Jamaica, and certain small islands of the Virgin group, notably Lovango Key of St. John, and Water Island of St. Thomas.

The account of tortoises by de Poincy (1658) may be questioned as referring to *Pseudemys,* the terrapin. It should be clearly understood that the territory covered by his book, Tobago to St. Croix, is entirely east and south of the known range of *Pseudemys.* However, *Pseudemys* was used as food and its bones do occur in kitchen middens in what is now its living range. The theory that the iguanas were carried about for food and hence may easily have become liberated, is entirely tenable since in historic times the Indians trussed these lizards and kept them as a food supply.

Authors from Du Terte (1654) to Grant (1932a and 1932b) record the presence of *Testudo* in the West Indies. However, Stejneger (1904), Schmidt (1928), and Barbour (1930), make no mention of the tortoise and

so by inference lead one to the conclusion that this reptile is nonexistent in Antillean territory. But Dr. Barbour, in a letter to the senior author, April 25, 1932, writes as follows:

> . . . We have land turtles brought back by the Blake Expedition from Porto Rico and I have seen one or two specimens somewhere labelled St. Thomas. All belong to the common wide ranging *Testudo tabulata* of northern South America which has been widely carried about as an animal eaten by man . . .

In another letter, May 10, 1932, he continues:

> . . . Speaking of *T. tabulata*, Mr. Agassiz and Mr. Garman knew of the turtle being on the islands when they visited them during the "Blake Cruises" in the early 1880's . . . We have a very large mounted specimen which Mr. Agassiz bought in Porto Rico and which is so labeled in the collection but Garman told me years ago that he heard it came from one of the small islands nearby.

Regarding the habits of some specimens of *Testudo denticulata* that the senior author kept as pets while stationed in Puerto Rico, a few random notes follow:

> June and July, 1932.—The pair of Testudos have mated several times. The male croaking or grunting while in coitus and at other times. Grunts for half hour at a time, several times a week. They eat bread but prefer mangoes and red hibiscus flowers. Eat pigweed but do not favor lettuce, and love bananas and papayas.
> *Testudo graeca* introduced as latrine scavengers by the Spaniards.

Pseudemys rugosa (Shaw)[1]

Antillean green terrapin or *Jicotea verde*

Testudo rugosa Shaw, Gen. Zool., 3, 1802: 28.
Pseudemys rugosa Flower, Vert. Anim. Zool. Soc. London, Rept. 3, 1927: 11.
Pseudemys rugosa De Sola and Greenhall, Copeia, 3, Oct. 7, 1932: 129–130, 2 figs.

Greater Antilles: Cuba, Jamaica, Hispaniola, and Puerto Rico.

Pseudemys decussata Gray

Antillean brown terrapin or *Jicotea morena*

Pseudemys decussata Gray, Cat. Sh. Rept., Suppl., 1856: 47.
Pseudemys stejnegeri Schmidt, N. Y. Acad. Sci., 10, Pt. 1, 1928: 147–150, 2 pls.
Pseudemys decussata De Sola and Greenhall, Copeia, 3, Oct. 7, 1932: 131–132.

Greater Antilles: Cuba, Jamaica, Hispaniola, and Puerto Rico.

The status of *Pseudemys* in Puerto Rico remained uncertain to the senior author after two years study in the area, but with the help and collaboration of the junior author, who has had the opportunity to study the other Antillean representatives of the genus, he now feels in a position to put forth several claims in conjunction with the latter.

The natives say there are two species, the dark and the mottled. There was a temptation to record them but a desire to obtain a large series and the absence of immature or female specimens of *P. rugosa* forbade it. De Sola and Greenhall (1932) mention only males from Cuba. They indorse the validity of *P. stejnegeri* of Puerto Rico and allude to a note to the same effect in Copeia (Grant, 1931). Schmidt (1928) mentions the smaller size and lack of contact between axillary and fifth marginal shields as the specific character of *P. stejnegeri*. In the above note it was pointed out that

1 Alternative name *Pseudemys palustris* (Gmelin).

the senior author took several specimens larger than the largest one Schmidt mentions. Danforth (1925) states that he also has taken very large specimens in the Cartagena Lagoon of southwestern Puerto Rico. This left the relative positions of the axillary and the fourth and fifth marginals the only specific differences. The senior author, since his note in COPEIA (1931), has had the opportunity to examine between forty and fifty carapaces discarded by a *jibaro* who had eaten the reptiles. The evidence was convincing that the position of the axillary varied so much in relation to the fourth and fifth marginals that its position was not a specific character. The variation often occurs on the two sides of the same specimen. If *P. stejnegeri* differs from *P. decussata,* the specific characters await description.

De Sola and Greenhall (1932) state that the nails of the forefeet of males are elongated. It should be pointed out that their figure after Sowerby and Lear does not show the nails long enough. It shows first and fifth nails short. In reality, all five nails are approximately the same length. They usually lie close together and resemble the teeth of a comb. Another observation we have never seen mentioned is that the postocular stripe is red and present in both sexes of *P. decussata* (ex *P. stejnegeri*) but absent on the males of *P. rugosa.* Another observation is that the snout of the West Indian pseudemyd males is much sharper in profile than that of the females. The adult males are vicious.

These terrapins were used for food in ancient times and are still so used as is shown in citations further on in this paper. They could easily have been carried by man, but there is every reason to believe that they never persisted east of Vieques. The time element may be greatly underestimated by students who try to explain distribution by obscure phrases. We believe that the rise and fall of land, land connections, and submergence, was great and far-reaching. Coincident with this is the possible factor of continental drift.

An experiment to prove whether these terrapins could pass from island to island was tried by the senior author. Five specimens were placed in sea water in a bath tub for four days. The salt seemed to injure the eyes but the terrapins remained active. Two of them died the day after being returned to fresh water. The others seemed uninjured but were killed and preserved. Further experiments were stopped when the senior author was relieved from duty on Puerto Rico. We believe, however, that a very few miles of salt water would prove an effective barrier to these reptiles.

The senior author recorded the occurrence of *Pseudemys* sp. on Vieques, (Grant, 1932c). This is the easternmost record known of the West Indian terrapin and probably a new record for the island. The evidence that *Pseudemys* never occurred east of Vieques is convincing. Du Terte (1654), de Poincy (1658), and de Rochefort (1681), plagiarizing one another in their books which cover the Lesser Antilles, the Virgin Islands, and St. Croix, mention several reptiles, but *Pseudemys* is omitted. West (1793) in writing of the reptiles of St. Croix does not mention the pond terrapin. Taylor (1888) in listing the reptiles of St. Thomas does not mention pond terrapins. Miller (1918) writes: "Shells and limbs of sea turtles . . from St. Thomas . . and St. Croix . . appear to be referable

to *Chelonia mydas* . . Of the freshwater *Pseudemys palustris,* whose remains occur freely in the Indian deposits of Cuba and Santo Domingo, there is no trace." The senior author has collected carefully on the Virgin Islands except St. Croix and found no trace of *Pseudemys* in fact or legend.

Some interesting notes on this terrapin in its range follow: Exquemeling, the pirate (1678) mentions the occurrence and edibility of the numerous examples in Santo Domingo. Abbad y Lasierra writes (1788):

> . . . En las cabaceras de los rios y en las lagunas qué hay en ésta isla (Pto. Rico) se crian muchas gicoteas (espécie de tortugas); son pequeñas, pero delicadas, y abundantes de heuvos qué los naturales comen con gusto. Su concha superior esta dibujada naturalamente de cuadros de un color negro fino, el resto es de color más bajo y tirá á pardo . . .

Atiles records (1887): "La Hicotea. *Emys rugosa.*—Util por su carne." Stahl a little earlier (1882) wrote: "Jicotea. *Emys rugosa* (*decussata*), Sharv. [sic] oscura con los escudos algo verdosos con estrìas y puntos amarillosos; parte inferior amarilla." His description refers to *P. rugosa* as defined by De Sola and Greenhall (1932) and not to *P. decussata* (ex *stejnegeri*).

The native name of *Pseudemys* in Puerto Rico and the other Spanish-speaking islands is *hicotea,* archaic spelling gicotea, pronounced *ee-ko-tay-a.* On this de Armas writes (1888): "Eikothea quiere decir en griego, *parezco una diosa.* La translación del nombre, se haría por la semejanza en el sabor de la carne . . ."

Danforth (1925) mentions that the Puerto Rican form is seldom seen sunning itself, and on a trip to the Cartagena Lagoon, Danforth and the senior author were surprised to see a terrapin which had climbed into a dead bush at the shore. At a distance it gleamed in the sun and they mistook it for a bird. Many others were basking on masses of vegetation. They were very numerous on that occasion, December 27, 1931, but the following July, with only normal seasonal differences, very few specimens were seen.

Conclusions

I We believe that
   a) *Testudo denticulata* (ex *tabulata*) is endemic to the West Indies as it has been known from early times and has been taken alive and feral in the Virgin Islands by the senior author.
   b) The known Antillean distribution of *Testudo denticulata* extends from Cuba to the Virgin Islands and Guadeloupe. (Records are desired from the latter locality.)

II We further believe that
   a) *Pseudemys rugosa* (ex *palustris*) and *P. decussata* (ex *stejnegeri*) are probably completely coextensive in their range.
   b) Vieques Island is the extreme eastern limit of *Pseudemys* in the West Indies. A careful survey of the works listed in the Bibliography failed to produce any habitat records other than those given in our text.

c) There was not sufficient justification for separating *Pseudemys stejnegeri* from *P. rugosa*; this separation was probably due to the non-recognizance of the pre-existent form, *Pseudemys decussata.*[2]

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[2] In a later issue of Copeia the junior author records the presence of *P. decussata* in the Bahamas.

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Notes on Incubation and Growth of Alligators

By E. A. McIlhenny

I

ON June 18, 1931, an alligator started building its nest in a large clump of Egyptian papyrus (*Cyperus papyrus*) about fifty feet from shore in my wild life refuge on Avery Island, where I had liberated a lot of toe-marked little alligators in 1921.

The place was easy to get to, but there was no suitable location near the nest to put up an observation blind, so the actual construction of the nest was not watched. The builder was a young female, one of the lot I had marked for identification August 22, 1921, with her first nest.

The papyrus growth in which the nest was being built was very thick, about ten feet high, growing in about eight inches of water on the edge of deep water and close against a concrete retaining wall. These heavy, soft stemmed plants were mashed down at the location for the nest, by the alligator crawling over them. When I first saw the spot on June 18 at 8:30 A.M. a clearing had been made about eight feet by eight feet, and a considerable number of papyrus stems had been torn down and were piled in the center. The nest-builder backed into the deep water, which was only a few feet from the nest, on my approach, and watched me, but showed no fear.

At noon on the 19th, the nest was about two feet above the water, and as far as I could see, built entirely of the stems of papyrus. At noon on the 20th, the nest was two feet ten inches above the water with a six-foot four-inch base. The top part was now covered with grass roots, mud and decaying vegetation taken from below the water. At noon on the 21st, the nest was apparently finished. It had been raised a little higher, but the top had not been coned and slicked down, so I knew the eggs had not been deposited. Nothing was done to the nest on the 22nd. The eggs had not been laid at eight o'clock in the morning of the 23rd, but the alligator was on the nest and had begun to hollow the center. At noon on the 23rd, the eggs had been laid, the nest coned with trash and mud, taken from below the water surface, and slicked down. At two o'clock on the afternoon of the 23rd, I went to the nest with a couple of men, dropped a noose over the head of the alligator when she came out on the nest to defend it; measured the nest, which was three feet nine inches in height, eight inches being in water with a seven-foot base; measured and weighed the eggs, which averaged 2.61 inches long by 1.60 inch through, and weighed an average of two and one-eighth ounces; counted the eggs, which numbered thirty-four; placed a double registering thermometer with its bulb at the center of the eggs slanted so that its top was six inches below the top of the nest-material; re-covered the eggs and thermometer, firming down the nest-material

so that the nest was exactly as it had been; measured the mother alligator, who was seven feet three inches; turned her loose and departed.

This alligator was one of a lot of young hatched August 22, 1921, and easily identified by the toe-marks made and recorded when it was liberated. This was her first nest, and the first nest made by any of this lot. It is of interest here to note that the first nesting of this lot of alligators was nine years and ten months after hatching, and this under perfectly normal conditions.

During the incubation period this nest was visited almost daily and an exact record made of the maximum and minimum temperature of the nest at the eggs, and a corresponding record of the outside temperature in the shade. A record was also kept of the rain fall. The data thus gathered gives a pretty clear picture of the incubating temperature of an alligator's nest and the development of the embryo under normal conditions.

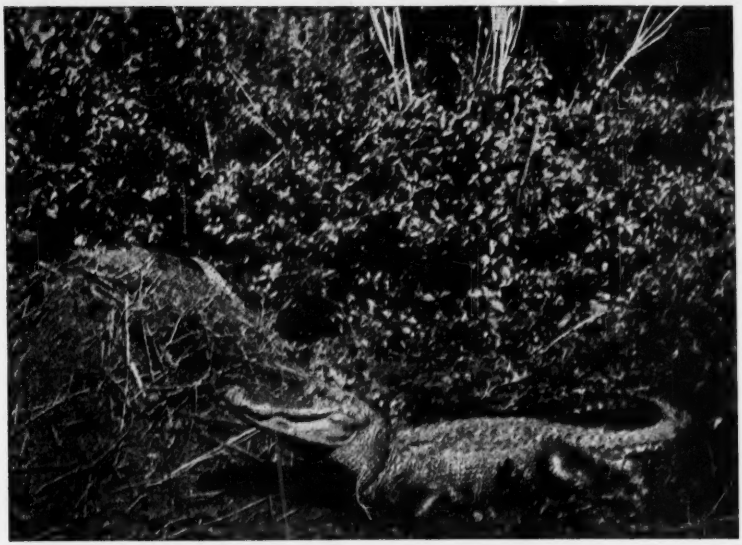
Some writers state that in alligator eggs, embryonic development starts before the eggs are deposited in the nest. This I have not found to be a fact, and I have examined the fresh eggs from many alligator's nests and the fully developed eggs taken from many killed alligators. The one egg opened from this nest the day laid was without sign of embryonic development. It is possible that should an alligator be kept from laying at the proper time that her eggs should be laid, due to drouth or other unusual causes, she will retain the eggs for a time in her body, and under such conditions embryonic development may start before the eggs are deposited in the nest. I have seen this very thing in the eggs of fresh-water turtles when kept during the laying season for a considerable time on hard surface in which they could make no nests, and therefore retained in their bodies eggs for several weeks past the time when they should have been laid. The embryos in such abnormally retained eggs begin development in the parent, but if the eggs are retained too long the embryonic development ceases and the entire inside of the egg becomes a tough yellow mass. If embryonic development has been found in the eggs of alligators while retained in the mother, it should be considered a most unusual occurrence and due to irregular causes. Having examined fresh eggs from hundreds of alligator nests, and the eggs taken from hundreds of freshly killed alligators without ever finding embryonic development in such eggs I make the above statement with great positiveness.

The following temperature records of this alligator's nest taken with the bulb of the thermometer set at the center of the egg clutch is, I believe, the first such record. It is of interest to note that following rain the nest's temperature is usually lowered. On days when there was no rain the mother would liberally wet down the top of the nest in order to prevent evaporation and the drying out of the nest material. There were ten and one-half inches of material above the top of the eggs and much more than this around the sides of the eggs. The eggs were laid in an irregular mass with none of the material from which the nest was built between them. I have opened hundreds of alligator nests and have never found the eggs deposited in layers with a covering of the nest material between them.

Date 1931	Temperature in Nest		Outside Temperature in Shade		Rain Fall in 100 of Inch	Remarks
	Max.	Min.	Max.	Min.		
June 24	102	100	95	75		The eggs were laid between
June 25	102	100	95	76		9:00 A.M. and 12:00 M. June 23
June 26	102	100	87	77		
June 27	102	100	82	77		
June 28	102	100	86	78	.63	
July 2	99	96	96	77		Opened one of the eggs, found
July 3	99	96	97	78		embryo but slightly developed
July 4	99	96	97	77		
July 5	98	96	93	78		
July 6	98	95	92	76		
July 12	96	93	89	76	.25	
July 13	96	93	90	79		
July 14	96	93	81	76	.72	
July 21	95	92	92	83		
July 22	95	92	93	76	.06	
July 23	95	92	93	77		
July 24	95	92	92	76		
July 28	95	92	95	77		
July 29	90	90	87	77	.82	
July 30	95	92	89	74		
July 31	95	92	94	76		
Aug. 1	92	90	86	76	.42	*Opened one of the eggs
Aug. 2	94	92	88	75	.18	
Aug. 3	94	92	88	76		
Aug. 4	94	92	95	78		
Aug. 5	94	92	95	76		
Aug. 6	94	92	93	76		
Aug. 7	94	91	92	77		
Aug. 8	93	88	92	77	.50	
Aug. 9	93	91	91	78		
Aug. 10	92	91	93	78	.14	
Aug. 11	92	89	97	75		
Aug. 12	92	89	87	66		
Aug. 13	92	88	87	66		
Aug. 14	92	86	88	66		
Aug. 15	92	84	88	68		**Opened one of the eggs
Aug. 20	93	88	83	76	.32	
Aug. 21	92	86	83	74		
Aug. 22	92	86	82	74		
Aug. 23	92	86	83	71		***The hard shell on the egg
Aug. 24	92	86	83	71		
Aug. 25	92	86	85	73		
Aug. 26	92	86	82	75	.46	
Aug. 27	92	86	87	73		
Aug. 28	..	..	..	..		****Young hatching today
Aug. 29	..	..	..	..		Young left the nest last night

*Opened one of the eggs, found the little alligator well developed, fully shaped and fully colored, with black and yellow markings as distinct as if naturally hatched. A considerable amount of the yolk was yet to be absorbed. The girth of the eggs is somewhat enlarged and the hard outside shell is cracked and spread, in many places showing the inside membrane.

**Opened one of the eggs today, the little alligator is fully developed, it can see and opened its mouth when my finger was put near it. The circumference of the eggs has increased and the outer hard shell is much cracked with two openings extending irregularly through it from end to end showing the tough inner covering of the embryo. The young alligator had a sharp point on the top end of its upper jaw pointing up. This point looks like the point on the beak of a young chicken when first hatched, and is undoubtedly for the purpose of puncturing the tough inner shell at the time of hatching. All the egg's liquid except about one-half tablespoon of the yolk had been absorbed. There was an opening in the skin of the stomach just forward



Female alligator guarding her nest.

Alligator nest opened to show eggs just hatching. Photographs by E. A. McIlhenny.

of the vent one and five-eighth inches long. The stomach membrane protrudes from this opening, and surrounds the remaining yolk. The stomach is quite distended. This little alligator moved its body very slowly due to the distended stomach. It was placed in a pan containing a couple of inches of tepid water and kept in my house. In six days the yolk had all been absorbed, the stomach opening closed and it was as normal as if it had not had a premature birth. The egg tooth on the point of the upper jaw disappeared on the seventh day.

***The hard shell on the eggs is now cracked all over, the eggs are much swollen with the hard outer shell crumbling off. The inner flexible shell is also getting soft and flaky and seems to be considerably thickened and disintegrating.

****The young alligators could be plainly heard grunting in the nest last evening, and this morning when I visited the nest the top material had been bitten off and thrown to one side by the mother, the recording thermometer with it, and the head and shoulders of a little alligator were pushed through the loose covering left on the top. On removing this loose covering a number of the newly hatched little ones could be seen, also some unhatched eggs. Eight of the little ones were toe marked, measured and weighed for future reference, put back in the nest which was covered up as it was found. All these little ones had a minute sharp egg tooth on the end of the nose. The mother was very uneasy all the time I was handling her young, and it was necessary to have two men with heavy wooden pitch-forks constantly watching to keep her from getting to me. The young measured from eight and one-half inches to eight and seven-eighths inches in length, and weighed one and one-half ounces to two ounces. On the morning of the 29th I visited the nest and found all the little ones had left.

This nest of alligator eggs took sixty-six days to hatch, several days longer than the average, which is from sixty-two to sixty-four days. This delay in hatching was probably due to two causes. First, the outside temperature chart shows the weather was cooler than usual for this section of Louisiana. Second, in opening the nest almost daily (although the opening was only about three inches square and closed as soon as the thermometer was read) it is possible the nest temperature was reduced slightly. The outside temperature did not seem to affect the inside nest temperature, and on some days the outside shade temperature was greater than the nest temperature, as on August 4 and 5 nest temperature 94°, outside temperature 95°—August 11 nest temperature 92°, outside temperature 97°.

II

On August 22, 1921, I weighed, measured, toe-marked and liberated thirty-eight newly hatched little alligators from a nest (the building of which I had watched) on the edge of my wild life refuge at Avery Island, Louisiana.

My object in marking and liberating these little alligators was to procure accurate data on the growth of alligators under normal conditions. This data was easily obtained by going into the open water of the Refuge in a boat at night and catching the alligators by the light of an electric head-light and with a heavy wire noose on the end of a stiff bamboo pole.

The following data gives an accurate record of their growth and proves conclusively one thing—that alligators under normal conditions in the wild grow much more rapidly than is generally supposed, and that both males and females average a little more than one foot increase in length per year up to and including the fifth year, and this increase in length growth is continued by the males at least to the ninth year, but after the fifth year the females increase in length much more slowly.

These alligators whose age, weights and measurements are here recorded were liberated at or near the place from which they were caught up to August 26, 1927; those recorded on that date and thereafter were killed, except the female taken June 23, 1931, who was liberated to guard her nest.

Date	Length	Weight	Remarks	Sex	Contents of Stomach
Aug. 22, 1921	9 to 9½ in.	2⅛ to 3 oz.	Of the 42 young hatched 38 were liberated with their mother after being marked		
Sept. 20, 1921	13½ to 14½ in.	.....	Eight young were measured today		
June 17, 1922	17¾ inches	8½ ozs.			
Aug. 22, 1922	2 ft. 2½ in.	4 lbs. 1 oz.			
Nov. 8, 1922	2 ft. 8 in.	5 lbs. 3 ozs.			
Nov. 8, 1922	2 ft. 3 in.	4 lbs. 4 ozs.			
Nov. 8, 1922	2 ft. 5½ in.	4 lbs. 6 ozs.			
April 12, 1923	2 ft. 5½ in.	3 lbs. 1 oz.	Very thin, 16 leaches in mouth		
May 2, 1923	2 ft. 8¼ in.	4 lbs. 1 oz.			
May 2, 1923	2 ft. 7½ in.	3 lbs. 9 ozs.			
May 2, 1923	2 ft. 7 in.	3 lbs. 10¼ ozs.			
Sept. 10, 1923	3 ft. 3 in.	9 lbs. 9½ ozs.			
Sept. 10, 1923	3 ft. 4½ in.	10 lbs. 6½ ozs.			
Sept. 10, 1923	3 ft. 5½ in.	10 lbs. 4 ozs.			
Sept. 10, 1923	3 ft. 11 in.	12 lbs. 7 ozs.			
Sept. 10, 1923	3 ft. 9½ in.	11 lbs. 8 ozs.			
April 13, 1924	3 ft. 8 in.	9 lbs. 4 ozs.			
April 13, 1924	3 ft. 8½ in.	9 lbs. 7 ozs.			
April 13, 1924	3 ft. 4½ in.	8 lbs. 5 ozs.			
April 13, 1924	3 ft. 9 in.	10 lbs.			
April 13, 1924	3 ft. 7 in.	8 lbs. 1 oz.			
Oct. 3, 1924	4 ft. 3 in.	17 lbs. 4 ozs.			
Oct. 3, 1924	4 ft. 6½ in.	17 lbs. 11 ozs.			
Oct. 3, 1924	4 ft. 9 in.	19 lbs. 1 oz.			
Oct. 3, 1924	4 ft. 2 in.	17 lbs. 4 ozs.			
Oct. 3, 1924	4 ft. 11 in.	21 lbs. 1½ ozs.			
June 13, 1925	4 ft. 3½ in.	16 lbs. 9½ ozs.			
June 13, 1925	3 ft. 10½ in.	11 lbs. 2½ ozs.			
June 13, 1925	4 ft. 5½ in.	15 lbs. 8 ozs.			
June 13, 1925	5 ft. 8 in.	29 lbs. 4 ozs.			
June 13, 1925	4 ft. 3½ in.	16 lbs. 2 ozs.			
June 13, 1925	4 ft. 4½ in.	16 lbs. 9 ozs.			
June 13, 1925	4 ft. 3½ in.	16 lbs. 7½ ozs.			
June 13, 1925	4 ft. 7½ in.	17 lbs. 1 oz.			
Oct. 10, 1925	4 ft. 7 in.	19 lbs. 8 ozs.			
Oct. 10, 1925	5 ft. 2 in.	22 lbs. 11 ozs.			
Oct. 10, 1925	5 ft. 6½ in.	27 lbs. 6 ozs.			
Oct. 10, 1925	5 ft. 1 in.	26 lbs. 9 ozs.			
Oct. 10, 1925	5 ft. 9¾ in.	38 lbs. 10 ozs.		♀	4 herons, 2 garfish
Aug. 26, 1927	5 ft. 6 in.	30 lbs.		♀	5 herons, 1 garfish, 1 turtle
Aug. 26, 1927	5 ft. 9 in.	36 lbs. 8 ozs.		♀	4 herons, 1 turtle
Aug. 26, 1927	5 ft. 7 in.	37 lbs. 2 ozs.		♀	7 herons, 2 turtles
Aug. 26, 1927	5 ft. 8 in.	38 lbs. 1 oz.		♂	8 herons, 1 turtle, 1 garfish
Aug. 29, 1927	6 ft. 7 in.	69 lbs. 4 ozs.		♂	7 herons, 1 snake, 1 garfish
Aug. 29, 1927	5 ft. 9 in.	43 lbs. 7 ozs.		♀	4 herons, 2 garfish
Aug. 29, 1927	5 ft. 4 in.	36 lbs. 8 ozs.		♂	5 herons, 3 garfish
Aug. 29, 1927	5 ft. 9 in.	41 lbs. 8 ozs.		♂	9 herons, 1 turtle, 2 garfish
Aug. 29, 1927	7 ft. 10 in.	124 lbs. 8 ozs.		♀	3 herons, 1 rabbit, 1 garfish
Aug. 29, 1927	5 ft. 6 in.	41 lbs.		♂	5 herons, 1 snake
Aug. 29, 1927	6 ft. 4½ in.	62½ lbs.		♀	2 herons, 1 muskrat, 1 snake
Aug. 29, 1927	5 ft. 3½ in.	33 lbs.		♀	5 herons, 1 turtle, 1 snake
Aug. 29, 1930	6 ft. 10 in.	84½ lbs.		♂	8 herons, 2 small turtles
Aug. 29, 1930	8 ft. 1 in.	126 lbs.		♂	10 herons, 1 turtle, 1 snake
Aug. 29, 1930	7 ft. 8½ in.	126½ lbs.		♂	4 herons, 3 turtles, 1 garfish
Aug. 29, 1930	8 ft. 4 in.	134 lbs.		♂	3 herons, 1 garfish, 1 snake
Aug. 29, 1930	8 ft. 9½ in.	149 lbs.		♀	6 herons, 1 turtle
Aug. 29, 1930	6 ft. 7 in.	89 lbs.			

Date	Length	Weight		Remarks
June 23, 1931	7 ft. 3 in.	116½ lbs.	♀	*Has nest near wall. This is the first nest built by the alligators hatched in 1921
July 29, 1931	8 ft. 10 in.	178 lbs.	♂	4 herons, 1 snake, 1 garfish, 2 turtles
July 29, 1931	9 ft. 2 in.	291½ lbs.	♂	7 herons, 2 garfish, 2 turtles
July 29, 1931	9 ft. 5 in.	283 lbs.	♂	5 herons, 4 turtles, 1 snake
July 29, 1931	7 ft. 1½ in.	110 lbs.	♀	1 heron, 1 turtle, 1 garfish
July 15, 1932	8 ft. 8 in.	169 lbs. 8 ozs.	♂	9 herons
July 15, 1932	10 ft. 1 in.	354 lbs.	♂	11 herons, 4 garfish, 4 turtles

This data is interesting from several angles. First, it gives an accurate picture of the normal growth of alligators in the wild state whose ages were definitely known. Second, it shows the difference in growth between males and females of the same age. Third, it shows under identical conditions how similar was the food of the different ones examined. It should be understood that these alligators had been liberated in a Wild-life Refuge in which a great many thousands of herons and other water birds nest, and that the waters of this refuge swarm with all sorts of fresh-water fish, turtles, snakes, and other creatures; thus the available food supply was unlimited and that used was undoubtedly the easiest to procure.

III

The following records of three nestings of alligators at Avery Island, Louisiana, are interesting:

First, because of the actual record of incubation period,

Second, because of actual measurements of the eggs and of the newly hatched young,

Third, because of the record of the length and weight of the mothers of each nest.

Nest No. 1
Eggs laid June 21, 1921
Eggs hatched August 22
Incubation period 63 days
Number of eggs 42
Average length of eggs 2.71 in.
Average width of eggs 1.67 in.
Average weight of eggs 3 1/16 ozs.
Average length of young 9.41 in. the day hatched
Average weight of young 2 5/8 ozs. the day hatched
Length of mother 9 ft. 1½ in.
Weight of mother 163½ lbs.

Nest No. 2
Eggs laid June 23, 1931
Eggs hatched August 28
Incubation period 67 days
Number of eggs 34
Average length of eggs 2.61 inches
Average width of eggs 1.60 inch
Average weight of eggs 2 1/8 ozs.
Average length of ten young 8.75 in. the day hatched
Average weight of ten young 1.75 ozs. the day hatched
Length of mother 7 ft. 3 in.
Weight of mother 116½ lbs.

NEST No. 3
Eggs laid June 2, 1933
Eggs hatched August 7
Incubation period 66 days
Number of eggs 41
Average length of eggs 2.63 in.
Average width of eggs 1.61 in.
Average weight of eggs 2¼ ozs.
Average length of young 9.19 in. the day hatched
Average weight of young 1 15/16 ozs. the day hatched
Length of mother 7 ft. 8 in.
Weight of mother 129½ lbs.

IV

I have record of a most unusual alligator nesting in 1933. On June 7, 1933, an alligator started scraping together some dry leaves and dry earth on top of a small point extending from my experimental planting garden into the water garden on the north side of my Wild Life Refuge. No grass or wet material was in the pile, which was about three inches high, on dry ground, when I first saw it. On the 8th, a number of eggs were deposited in a slight hollow in the loose material, the eggs lying on the hard ground, and when I saw the nest about eight o'clock on the 8th the top covering of the eggs was so light that a portion of some of them could be seen. At 10:30 the morning of the 9th about ten inches of dry earth, scooped up by the alligator's jaws from near the nest, had been placed on top of the eggs; the nest then measured fourteen inches high and thirty-eight inches across. This nest was visited every few days, and it was noted that the mother took care of her nest, for after each rain the top was slicked down by her crawling over it, and on dry days the top was made wet as is usual. On August 7th, thinking it was about time for the eggs to hatch, I made a small opening in the nest, took out one of the eggs, and on opening it was surprised to find the embryo only about two-thirds developed. A second egg was then opened with the same result. I was much surprised at the smallness of the embryo as the eggs should have hatched in from two to six days longer, it being sixty days since they were laid. On trying to determine the cause of the slow embryonic development, I noticed there were no grass or leaves or other organic matter used in building the nest and that the eggs were in a solid bed of fairly dry earth. The nest was visited after, and I noticed the mother ceased visiting the nest on August 14, when she evidently believed the time for hatching had passed. On August 31, I again opened the nest and opened a couple of the eggs, finding the embryos about three-fourths developed, and a large amount of the white and yolk yet to be absorbed. The little alligators were apparently normal and when removed from the eggs could see, and would open their mouths when my finger was put near their heads. I closed the nest and did not open it again until September 22, when, while standing near it, I thought I heard the grunt of a little alligator. The first egg I uncovered had the head of the little one sticking through the shell and as soon as the egg was lifted from its packed position the little alligator scrambled out in a lively manner. I then uncovered all of the eggs, and from the thirty-one left in the nest, eight little

alligators popped out as soon as the eggs were released from their packed position. In the rest of the eggs the young were fully developed but dead. The reason that these eggs hatched forty-three days after they should have hatched, was evidently due to the fact that they had had no artificial heat to stimulate embryonic development, as no green plant-material had been used in the nest-building.

AVERY ISLAND, LOUISIANA

The Rate of Growth of the Toad (*Bufo americanus americanus* Holbrook) under Natural Conditions

By W. J. HAMILTON, JR.

FOR many years workers dealing with growth of amphibians have allotted these animals various ages, based solely on size groups. A number of a given species are taken at one time, in the same place, preferably very early in the spring when seasonal growth has but commenced, or late in the fall, when growth has ceased for the year. These are then measured and frequently found to fall in certain length groups, each group of which is assigned an age. Such reasoning is based on purely presumptive grounds, as Wright[1] (1931: 59) has stated. This author has added:

"But what the resident naturalist can do is to mark frogs or keep them in some pond enclosure and get the real growth of an individual or individuals."

Others have kept captive animals and attempted to simulate natural conditions, that the captives might grow as normally as they would in the wild state. Lack of exercise and natural foods, together with an absence of the proper humidity and temperatures, usually result in a failure of an animal to grow as it would in a natural condition.

The only normal method by which we may determine the approximate rate of growth under natural conditions is to mark the animals in some manner that they may be readily recognized at a later date. Recaptures from time to time, and notes made on the increase in length, weight, etc., will add to our knowledge of the rate of growth of these animals under natural conditions.

The data recorded below have been made principally about the author's home, three miles east of Ithaca, New York. Observations on marked individuals were carried on, as often as the toads could be recaptured, from May 12, 1932, to September 20, 1932, and in 1933 from May 20 to September 27. From mid-May until late in September, in central New York, toads are abundant, After the first few frosts they are less frequently

[1] Wright, A. H., 1931. Life Histories of the Frogs of Okefinokee Swamp, Ga.

seen, but a warm night with rain may bring them out in November. Such a night occurred November 14, 1931, when many toads were seen.

We may thus judge the normal activities of the toad to be carried on from early May until October, over an approximate period of five months. This would, of course, constitute the growing season.

In 1932 eleven individuals were marked, by incising one or more toes on the fore feet. They were also measured, weighed and liberated. One was recaptured seven times, two were recaptured three times, one recaptured twice, while four were retaken once each. In 1933, of nine marked and released, four were recaptured after being marked. All of these were retaken but once, except one, which was collected thrice during the summer.

1932 Records of Individual Growth

No. 1. First captured June 5, 1932, when the animal measured, in total length, 37 mm. and weighed 6 grams. The second toe on the left fore foot was incised and the animal released. On June 11 the animal was recaptured, and measured 41 mm. and weighed 7 grams. Thus in six days the length had increased 4 mm. and the weight 1 gram. On June 15 the toad was retaken, and measured 43 mm. while an additional gram had been added to its weight. On July 8 the animal was 58 mm. and the weight increased to 18.3 grams. On July 25 the toad measured 63 mm. and the weight was 25.5 grams. On August 4 the animal weighed 30 grams and the length increased to 70 mm. Two weeks later, when the toad was weighed and measured, no increase in either length or weight was apparent. On September 10 the animal measured 72 mm.

Thus we have a growth, at least, of 35 mm. during the summer in this individual and a gain in weight from 6 grams to 30 grams. It is of interest to note that the most rapid growth occurred during June and July. During this period, more than 80 per cent of the growth was accounted for. August and early September growth was negligible. This toad was apparently a male.

No. 2. A large female toad first taken on July 8, 1932, measured 79 mm. The tibia had a length of 51 mm. On July 23 it was recaptured, and had increased to 96 mm., while the tibia measured 53 mm. On August 19 the toad measured 96 mm. and the tibia 56 mm. On August 28 the animal showed no increase in size.

No. 3. A female taken July 5 measured 58 mm. Retaken July 27, it measured 63 mm. Recaptured on August 12, it measured 70 mm. and when last taken, on September 20, the toad measured 74 mm.

No. 4. A small toad collected May 12, 1932, measured 32 mm. in length and weighed but 6.1 grams. It was recaptured only once, on September 10, and had greatly increased in size, when it reached a length of 68 mm. The weight showed a like increase, amounting to 33 grams.

No. 5. A companion to No. 4, taken on May 12, measured 35 mm. and weighed 3.9 grams. Recaptured on August 19, it measured 73 mm. and weighed 35 grams.

No. 10. An adult female toad, collected on July 23, measured 67 mm. On August 28, the animal measured 74 mm., an increase of but 7 mm. in five weeks. Apparently the most rapid growth occurs in early summer, and size increases most rapidly in young individuals.

No. 11. An adult female taken on August 30, 1932, measured 64 mm. June 5, 1933, the animal was recaptured, and showed a gain in total length of 18 mm. and an increase in tibial length from 41 mm. to 50 mm.

1933 Records of Individual Growth

Nine toads were marked and released. Of these, four were recaptured. All those recaptured were apparently year old toads. They were first collected in a swampy area and carried four miles distance to the writer's home where, after being marked, they were liberated. Apparently no homing instinct was developed at this precocious age, for they were retaken within a few rods of the point of release.

No. 13. The toad when first collected on May 1 had a total length of 34 mm. and weighed 3 grams. It was recaptured twice, first on June 7, when the length had increased to 47 mm. and the weight to 11.9 grams, and again on August 28, when the animal measured 68 mm.

No. 16. A specimen taken May 1 measured 49 mm., and when next observed, on June 27, measured 59 mm.

No. 17. A toad measuring 48 mm. collected, marked and released on May 1, measured 48 mm. in length and weighed 11.2 grams. It was handicapped by a missing right hind foot, the member merely a stub. In spite of this setback, the toad grew as rapidly as others studied, and when finally found on September 17 had increased in length to 71 mm. and weighed 29 grams.

No. 20. A toad measuring 30 mm. in length on May 1, was retaken but once, June 7, when it was found to have increased in length to 41 mm.

At this relative rate of growth, we may argue that young toads, at least, double their length the second year, and appear, at least in the males, practically full grown at the commencement of the third year. It is quite possible, then, that the males we encounter in the breeding period are but two, or at most, three years of age, that is, two or three years from the egg. It certainly does not seem likely that they would mature later than the third year, at most, and it seems quite probable that females likewise reach maturity at three years.

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Herpetological Notes

FEEDING *FARANCIA ABACURA* IN CAPTIVITY.—There are few references to the feeding habits of the mud snake, *Farancia abacura*. Ditmars, in "Snakes of the World," describes one that ate tadpoles in a large shallow pan of water in which the snake had an opportunity to swim about. O. C. Van Hyning (COPEIA, April, 1932) examined the stomach contents of twenty-five examples and found "mud eels," *Siren lacertina*, in seven stomachs. None of my specimens has ever eaten tadpoles even under the conditions outlined by Ditmars and inquiries made to curators of several zoos and some private collectors show that they have had no success whatever in feeding this snake. Most collectors do not care to keep the species because of the certainty of starvation.

Early in April of this year a young friend and I saw a mud snake swallowing an amphibian in a drainage ditch near here. We were unable to catch the specimen but it was evident that the victim was what is called locally a "lamp eel," or by the negroes "lamp-eater." It is very common here and several were obtained and identified as *Amphiuma tridactylum*, popularly known as the "Conger eel" in other sections of the country. (Thanks are due Mr. J. N. Gowanloch, Biologist of the Louisiana Conservation Commission, for the exact classification.)

Farancia abacura swallowing *Amphiuma tridactylum*. May 13, 1934.

Two specimens of *F. abacura* were already on hand; one of these 57 inches long and about 2 inches in diameter and the other 55 inches long and of about the same diameter. The first experiment was with the larger snake and a small *Amphiuma* 12 inches long, both the snake and the "eel" being placed in a pan of water too small for the snake to swim in. The amphibian was eaten promptly, but the writer was not present when the actual swallowing occurred. Later in the day the same snake was placed in the same dish of water with an *Amphiuma* about 25 inches long and of approximately the same diameter as the snake. The snake attacked the amphibian without a moment's hesitation, seizing it near the hind legs and "wrestling" with it so violently that both were thrown out of the pan of water onto the ground. The hold was never released subsequently, although the "eel" repeatedly bit the snake on the body and about the head. The extreme vigor with which the snake attacked and

fought with the amphibian was in marked contrast to the sluggishness of the reptile under other circumstances.

The struggle was witnessed by an excited and noisy group of six or seven persons. In order to obtain pictures of the feeding the snake and victim were moved about frequently by hand and with a "snake hook," but the snake was not at all distracted by these disturbances. Soon after the amphibian had been seized, the snake started working his jaws toward the tail and when this was reached the engulfing proceeded with much struggling on the part of the victim and repeated attempts to bite his captor. The entire feeding time from the first seizure until the disappearance of the amphibian's head was about an hour and a quarter.

This occurred on May 1. On May 4 the other mud snake was fed with two small specimens of *Amphiuma* about 14 or 15 inches long. The writer was not present when these were eaten but there were several witnesses. On May 8 this same snake was placed in the water pan with a large "eel" (27 inches long) although it was not thought probable that it would be ready to feed after an interval of only five days. Almost instantly the snake seized the amphibian near the middle of the body and the spectacular struggle described above was repeated. The viciousness of the snake's attack and the complete indifference to noise and disturbance were again most noticeable. This time the victim was swallowed head-first, the engulfing being more rapid than in the first instance in spite of the larger size of the amphibian. Moving pictures of this feeding were obtained.

The other feedings occurred under much the same circumstances. On May 13 snake No. 1 ate another large *Amphiuma*, the third one in less than two weeks. The second snake swallowed two large ones on May 16 in spite of the fact that it had had two heavy meals within the preceding twelve days. This particular snake ate five specimens of *Amphiuma* in the three feedings described and the combined bulk swallowed must have been nearly as great as that of the snake.

A third specimen of *F. abacura* (about 52 inches long and more slender than either of the other two) refused to feed on several occasions when food was offered to it under the above conditions, but it finally ate one small *Amphiuma* ten inches long.

From the experience here reported it seems fairly certain that the favorite food of *Farancia abacura* is *Amphiuma* and probably any other of the tailed amphibians. Instead of being a reluctant feeder it has proved to be one of the readiest snakes to feed and it would appear that this beautiful reptile can now be kept in good condition in captivity if this type of food is available.

SUMMARY:

1. *F. abacura* was observed in the wild state swallowing an amphibian, *Amphiuma tridactylum.*

2. One captive specimen ate three specimens of *Amphiuma* in three feedings; a second one ate five in three feedings; all in a space of two weeks. A third specimen ate one small *Amphiuma.*

3. The avidity and vigor with which the reptiles attack the amphibians is in marked contrast with the sluggish, timid character of this species. Noise and disturbance during the feeding do not distract the snakes.—GEORGE P. MEADE, *Gramercy, Louisiana.*

THE CALIFORNIA TOAD IN RELATION TO THE HIVE BEE.—For some time there has been doubt as to the importance of the honeybee in the dietary of the garden toad. Occasional reports can be found in bee journals as to the toad's proclivity toward the eating of bees in the apiary but little specific information is available. The presence of numerous toads in the queen rearing yard of the University of California, at Davis, together with the unusual weakness of some of the nuclei, caused the writer to make some observations that might be of interest to the readers of COPEIA.

The queen-rearing yard and general apiary adjoin a drainage ditch which forms an ideal breeding place for toads. The ditch banks also contain the dens of a few families of skunks. After the breeding season, the toads leave the ditch and scatter in all directions, seeking favorable situations for further development. Many of them find suitable locations in the apiary and around the adjoining buildings.

During the present summer, the indications of visits from the skunk were not numerous but comparatively large droppings, thought at first to be those of the skunk, were found in large numbers in various portions of the apiary. These droppings were more numerous in the vicinity of bushes and water hydrants where the soil was kept moist by irrigation. Traps were set for skunks but only toads were caught in them.

Observation has shown that both skunks and toads generally feed at night when bees normally are confined to their hives by darkness. Toads, however, may come out to feed just after sundown when bees are clustered at the hive entrances. On hot summer nights, bees may remain clustered out all night, and a number of them will be busily engaged in ventilating the hive by fanning. Observations on moonlit nights revealed the presence of a large number of toads in different parts of the apiary, sixteen being counted around one row of twelve hives. Some were seen sitting at the entrances of hives with their fore-feet on the bottom boards.

An examination of the stomach and colon of a medium-sized California toad (85 mm. or 3 5/16 inches long) disclosed the presence of 33 heads of bees, 7 elytra of beetles, 31 ants (more or less intact in the stomach), 4 small arachnids, and some extraneous vegetable matter. Many other chitinous parts of insects were also present, including the wings, legs, antennae, stings, tongues, and the thoracic and abdominal segments of bees, but only the heads were counted as an indication of the number of bees that had been captured by this particular toad. A few days later, after the droppings had been positively identified as belonging to toads, 22 individual droppings were examined separately and a total of 514 heads of bees were found, an average of 23.3 bees each. The largest number of heads found in any one dropping was 38, while the smallest number was 13. The droppings are elongated oval in form, slightly curved, blunt on one end, and frequently quite pointed on the other. The average dimensions of 16 samples, taken at random, were 32.2 x 12.1 mm. The largest sample measured 39 x 15 mm. while the smallest was 26 x 11 mm.

From the above observations it is evident that the toad has no place in the apiary. If the gardener wishes to keep toads around for the benefit they do in destroying harmful insects, and desires to locate hives of bees in the garden as well, the hives should be placed on stands so their entrances will be out of reach of toads.—J. E. ECKERT, *Davis, California.*

SOME REPTILES AND AMPHIBIANS FROM MALHEUR COUNTY, IN EASTERN OREGON.—The following material was gathered during the three months from June 21, 1931, until September 12, 1931, and in the summer of 1932, while the author was staying in a construction camp located about 15 miles south of Nyassa, Oregon, on the Owyhee River.

Typical desert conditions prevail in this locality. Dry, hot, sandy bottoms dotted with sagebrush are found bordering the river. Talus slopes, sparsely covered with grass and sagebrush, rise from the river and bottoms of gulleys leading to the river to terminate in cliffs of basalt or volcanic cinder.

Of the reptiles present, the lizards were the most conspicuous and numerous. The six species of lizards collected represented all of the species observed. Only three species of snakes were collected, though at least two other species were seen, The specimens taken were identified by Dr. Philip H. Pope, of Whitman College, Walla Walla, Washington, and his identifications were confirmed by Mr. L. M. Klauber, San Diego, California.

All of the lizards were captured with a noose designed by Edgar C. Brooking. It was made of heavy, galvanized wire, looped for a handle at the top, kinked twice in its four feet of length to make guides for a draw-wire, and with two small kinks at its distal end. About four inches of fishline was tied to one of the two kinked loops at the end, and passed through the other, tying onto a light draw wire which extended to the handle. (A draw string was not successful because the slack could not be taken up quickly enough.)

LIST OF SPECIES

1. *Bufo woodhousii* Girard.—One male and one female of this species were taken on August 22, 1932, very early in the morning from a low, weed covered flat bordering

the river. Apparently they are not numerous. This appears to be the first record for this species from Oregon.

2. *Rana pipiens* Schreber.—Two specimens of this species, taken from the river, were the only frogs observed. No young were seen, and frogs appear to be scarce in the locality.

3. *Crotaphytus collaris* (Say).—These lizards are quite numerous and were often seen surveying the country or carefully watching the approach of any moving object. At such times they often stand with front feet on a stone and stretch neck and front legs as high as they can to get a better view. Sometimes before running away they bob up and down several times in rapid succession and then leave. They can run with great swiftness; sometimes on the hind feet alone, with the front feet clawing the air and the tail sticking up behind. They were found in rocky places where there was some sand and sagebrush and could usually be approached if no rapid movements were made. It was not especially hard to slip a noose over their heads but they were apt to jump clear through it if the collector was slow in pulling it tight. The first young one was taken on August 19, but appeared to be several days old.

4. *Crotaphytus wislizenii* Baird and Girard.—These lizards, wearing spots like those of a leopard, are particularly vicious. Whenever they were placed in a collecting can with another lizard they immediately attacked the other lizard and often had it bleeding about the head or neck within a very short time. They inhabit sandy bottoms where there is plenty of sagebrush and few rocks. They usually crouched low and motionless on the sand when approached, but considerable care was required to get close enough to noose them. There were comparatively few of them in that locality, only three being seen and collected during the summer. No young were observed.

5. *Phrynosoma platyrhinos* Girard.—The least numerous of the lizards found in that locality. Only two were seen during the summer, both in areas where the sagebrush grew on very rocky ridges. I was told on good authority that five were seen within a radius of a few yards early one morning, but such a group was never found again.

6. *Sceloporus occidentalis biseriatus* (Hallowell).—The only species found which was confined to extensive piles of rocks where there were plenty of cracks and crevices in which to live. The first young were observed on July 25. Members of this species were quite numerous and it was easy to approach to within four or five feet of them. If frightened by a sudden noise or movement they dived into a crevice and usually could be seen somewhere watching intently. It was often possible to capture them by slipping the noose over the lizard's head. Often they snapped at the noose, as if it were something to eat. They do not seem to learn very rapidly. One large one that had been noosed, wriggled out of my hand. As he left, I caught him by the base of the tail, which snapped off and wriggled violently while the lizard whisked into a crevice. He was fished out three times within the next five minutes and seemed no wiser than when first caught.

7. *Uta stansburiana stansburiana* (Baird and Girard).—These little lizards are very numerous and the most widely distributed species. They were found in the sandy flats, in rough, rocky places and even up near the bare basalt cliffs. They were the easiest species to approach and as easy to noose as any of the other lizards. Much individual variation in color was observed among the specimens taken in different types of habitat. Those on the sandy, steep banks of the river or in dry washes were almost grey, while those from the rough, bare, rock areas were more nearly brown. Still others from the sagebrush-covered ridges were usually dull tan, shading almost into an olive green at times. The first young were taken on July 27, after which time they were seen quite often.

8. *Cnemidophorus tessellatus tessellatus* (Say).—This species was most abundantly found in the sandy, sagebrush-covered bottoms along the river. These slender animals are the fleetest of all the lizards in that locality. When they run they look like a grey streak leaving little puffs of sand where their feet strike the ground. Often they run on their hind feet alone, with front feet tucked down close to the belly and long, whip-like tail lashing the air behind them. They stop with an abruptness that confuses the eye of the observer, and often hide behind a sagebrush very effectively.

They are hard to approach and noose because of this nervous shyness. They become less shy if they run away and are successfully followed two or three times. Juveniles of this species were observed about July 15, 1932, along a dry creek bed.

9. *Masticophis taeniatus taeniatus* (Hallowell).—Only one of these snakes was observed. It was taken in a dry, sagebrush-covered gulch about a mile east of the river, late in the afternoon of August 19. It was quite active and when chased it climbed into a sagebrush and stuck its head out threateningly. It repeated this performance three times before it was captured. The stomach of this snake contained a full grown lizard, *Crotaphytus collaris,* swallowed tail first.

10. *Thamnophis ordinoides vagrans* (Baird and Girard).—Abundant along the Owyhee River. They were most often seen lying in the water along the edge of the river or swimming in it.

11. *Crotalus confluentus lutosus* Klauber.—Rattlesnakes were quite numerous and were often found in or near the large building housing the air compressing machinery. They were usually found late in the evening, sometimes as late as 9 or 10 o'clock, and several were caught in the act of entering the compressor room. The noise and vibration of the heavy machinery may have attracted them. I succeeded in catching a specimen one evening before the compressor operator mangled it beyond recognition.

Another very active specimen was taken about 9:30 P.M. along a narrow gauge railroad track. He was first observed following the track bed down the coulee, and when an attempt was made to capture him, he immediately coiled and prepared to fight. He then crawled under a tie and was extracted with difficulty because of his activity and the uncertain light.—WALTER J. BROOKING, *Whitman College, Walla Walla, Washington.*

REDISCOVERY OF THE RED-BELLIED WATER-SNAKE, *NATRIX SIPEDON ERYTHROGASTER* (FORSTER), IN MICHIGAN.[1]—Although the red-bellied water-snake or "copperbelly," *Natrix sipedon erythrogaster* (Forster), has been reported from Michigan by several writers,[2] Ruthven *et al.* (1912: 96; 1928: 108) gave no account of it in their "Herpetology of Michigan" except to mention it briefly and reduce it to the synonymy of *N. s. sipedon* (Linné) on the assumption that it is only a color phase of the latter, and Blanchard (1925: 10), while recognizing[2] *erythrogaster* as subspecifically distinct from *sipedon,* gave southern Illinois as the nearest part of its range to Michigan. The concept expressed by Ruthven is held by some herpetologists, *e. g.,* Stejneger and Barbour in the three editions of their "Check List." On the other hand, some workers have found evidence which led them to believe that *erythrogaster* and *sipedon* are taxonomically distinct.[3] The writer, who is engaged in a taxonomic study of this and certain other forms of *Natrix,* believes the latter to be the more tenable conclusion. A probable explanation of the omission of Michigan from the range as given by Blanchard is that he felt there was insufficient evidence of the natural occurrence of *erythrogaster* there, inasmuch as the only indisputable records, that of Clark who described carefully several specimens from a single locality in Eaton County, and the lone specimen from Lansing in the U. S. National Museum, might be explained as chance introductions. The plausibility of this interpretation rested on the fact that these records were far north of the otherwise known range of the form.

Recently, however, the natural northward occurrence of *erythrogaster* has been demonstrated by Roger Conant, of the Toledo Zoological Society, who shows (1934: 21-30) that this snake occurs as a relic in several scattered localities in Ohio. One of these localities, in Williams County, is so near to southern Michigan that it seemed expedient to search the place in which Clark had worked. Accordingly, on May 17, 1933, a party from the University of Michigan, with Mr. Conant, visited the exact area[4] near Olivet, Eaton County, Michigan, that was studied by Clark thirty years before. Notwithstanding an unfavorably cold day two specimens of *erythrogaster* and one of *sipedon* were taken. These have been deposited in the University

[1] Contribution from the Zoological Laboratory of the University of Michigan.

[2] Smith, 1879: VI; Cope, 1900: 977; Clark, 1903: 2; 1904a: 194; 1904b: 172; Gibbs *et al.,* 1905: 109; and Notestein, 1905: 117.

[3] Clark, 1903: 19-23; Blanchard, 1922: 12; and Conant, 1934: 21-30.

[4] Dr. Hubert Lyman Clark, now of the Museum of Comparative Zoology, kindly furnished us with specific directions for finding the area.

of Michigan Museum of Zoology (Nos. 74510 and 74511 respectively). Later, another *erythrogaster* (U.M.M.Z. No. 57863) collected in the same locality in 1923, was found in this museum catalogued under *Natrix sipedon sipedon*. The specimen (U.S. Nat. Mus. No. 1341) reported by Cope is labelled "Lansing, Michigan," and thus appears to have been taken about twenty-five miles to the northeast of Olivet. It was examined and its identity verified. All of the *erythrogaster* specimens are included in the "Table of Measurements" below.

If it be concluded that *erythrogaster* is taxonomically distinct from *sipedon*, then it must be recognized as occurring naturally, but as a relic, in a small area lying just eastward of Olivet, Eaton County, Michigan. Whether it still occurs at Lansing is problematical. However, we may predict future discoveries of this snake in other suitable localities in the extreme southern part of the state.

The writer is pleased to acknowledge his indebtedness to Professor Frank N. Blanchard for kindly advice and criticism in the preparation of this paper.

TABLE OF MEASUREMENTS

Natrix sipedon erythrogaster (Forster)

Museum	Cat. No.	Locality	Sex	Scale Rows	Ventrals	Caudals	Labials	Oculars	Temporals	Total Length (in mm.)	Tail Length (in mm.)
U.M.M.Z.	57863	Olivet, Mich.	♂	21-23-17	153	75	8,10	(l) 1,2 (r) 1,3	1+63	890	...
do	74510	do	♀	21-23-17	158	64	8,10	1,3	1+3	685	143
do	74511	do	♂	23-23-17	150	77	8,10	(l) 1,3 (r) 1,0	1+3	1110	243
U.S.N.M.	1341	Lansing, Mich.	♂	23-25-17	153	64	8,10	1,3	1+3	985	212

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1933 *Idem.* 3rd ed.: xiv + 1-185.

WILLIAM M. CLAY, *Zoological Laboratory, University of Michigan, Ann Arbor, Mich.*

Ichthyological Notes

ARSENIC STORAGE IN GAME FISH[1].—During June, 1933, while investigating alleged pollution of the Yellowstone River by mills handling arsenical ores, an arsenic hazard to man through arsenic storage in game fish was discovered. Two trout, *Salmo lewisi* (Girard), five whitefish, *Coregonus williamsoni cismotanus* Jordan, one sucker, *Castostomus griseus* (Girard), and one dace, *Rhinichthys cataractae dulcis* (Girard), caught by hook and line from the Yellowstone River near Gardiner, Montana, were analyzed for arsenic by the Berzelius-Marsh, Betendorff, Flückiger-Lehmann and Bang methods. Two of these fish, one trout and one whitefish, were found to contain stored arsenic in the musculature. Trout from Yellowstone Lake, however, were arsenic-free.

As both trout and white fish were feeding almost entirely on nymphs of a large species of stone-fly (*Perla* sp.), which is very abundant under stones in the Yellowstone and its tributaries, several hundred of these nymphs were collected from the Yellowstone and Gardiner River and each lot analyzed *en masse* for arsenic. The nymphs from the Gardiner River were arsenic-free while those from the Yellowstone River contained arsenic.

It seems probable, therefore, that the trout and whitefish had stored arsenic cumulatively from stone-fly nymphs taken as food. The ultimate source of the arsenic is still a question since the Montana State Board of Health in 1923 found arsenic in the unpolluted Yellowstone above the arsenic mills as well as in the waste waters from the mills (personal communication to writer). Confirmatory analyses made by the writer in 1933 show that even after the addition of mine wastes the actual arsenic content of the waters of the Yellowstone is very small (0.006 parts per million as arsenic trioxide). Whether arsenic storage by game fish in this region is a usual occurrence or not, the finding of two arsenic-carriers in a lot of seven game fish, and demonstration of arsenic in insect nymphs on which these fish were feeding point out a possible hazard to man from game fish caught in waters carrying arsenic even in high dilutions. In this connection it may be mentioned that during the past 10 years several sportsmen and others have reported sudden violent illness suggestive of arsenic poisoning following meals including game fish caught in this part of the Yellowstone. The data table follows:

Material	Arsenic as element, mgs. per kilo.			
	Viscera		Musculature	
	Wet	Dry	Wet	Dry
Trout	5.3	19.6	2.4	17.4
Whitefish	3.6	20.1	2.7	18.4

Perla nymphs *en masse*, wet 0.1, dry 0.6

M. M. Ellis, *U. S. Bureau of Fisheries Research Laboratory, University of Missouri, Columbia, Missouri.*

RECORD OF THE ALEWIFE FROM LAKE HURON.—On March 28, 1933, Capt. Alex. Purvis, Commercial Fisherman of Silverwater, Ontario, forwarded a specimen to the Fish Culture Branch of the Department of Game and Fisheries, Toronto, Ontario, for identification; the specimen in question was identified as *Pomolobus pseudo-harengus* (Wilson).

The specimen was taken in a gill-net operated about 12 miles east of the outer Duck Island (Manitoulin) in approximately 70 fathoms of water. Previous to taking this specimen, Capt. Purvis reported that he had seen only two of them, but later. in the summer of 1933, more than a dozen were taken. Commercial fishermen operating out of Providence Bay also reported finding a few specimens.

The species is known to occur in abundance in Lake Ontario. An odd specimen has been taken in Lake Erie, but before this specimen was taken and identified, a record was unknown for Lake Huron, in view of which this note seems worthy of publication.—H. H. MacKay, *Ontario Department of Game and Fisheries, Toronto, Ontario.*

[1]Published by permission of the Commissioner of Fisheries.

ZAPRORA SILENUS JORDAN FROM ALASKA.—Through the kindness of Dr. Carl L. Hubbs, Curator of Fishes, Museum of Zoology, University of Michigan, I was able to study a collection of fishes made by W. J. Eyerdam in Alaska.The collection contained a few fish of special interest, notably 8 specimens of the highbrow, *Zaprora silenus*, between the lengths of four and ten inches. They were collected as follows: one at Akutan Island, Alaska, in a herring seine during the summer of 1931; two at Port Hobron, Sitkalidak Island, by hook and line in September, 1931; one at Port Hobron, in a herring seine in September 1931; two in Sitkalidak Straits, Alaska, in a herring seine on September 16, 1931; and two in Bolling Bay, Kodiak Island, in a herring seine on October 6, 1931. In the description of the family Zaproridae, Jordan (Proc. Calif. Acad. Sci., 6, 1896: 203) and again Jordan and Evermann (Bull. U. S. Nat. Mus., 47, 1898: 2847) made the statement, "gill membranes separate, free from the isthmus." That statement is untrue as found by an examination of the gill membranes of these 8 specimens and one additional frozen specimen, which is nearly two feet long and at present is stored in the Spokane Street cold-storage plant of the Port of Seattle. The gill membranes are broadly united to each other and form a wide free fold across the isthmus. The cold-storage specimen was taken off the southwest coast of Vancouver Island many years ago. The occurrence of *Zaprora* in the vicinity of Sitkalidak and Kodiak Islands represents the known western limit of its range (see Dymond, COPEIA, 167, 1928: 88).—LEONARD P. SCHULTZ, *Department of Fisheries, University of Washington, Seattle, Washington.*

A NOTE ON THE ROLE OF VISION IN THE SPAWNING MIGRATION OF TROUT.—Several investigators have attempted to isolate the factors which influence the spawning migrations of salmonoid fishes and a significant part of this inquiry has been the effort to determine the importance of the various sensory organs through which the characteristic responses are affected. Craigie[1] has adduced evidence to show that cutting the olfactory nerves may affect the migration of sockeye salmon (*Oncorhynchus nerka*), but his results were modified because the fish with cut olfactory nerves may have associated with the normal ones and migrated in company with them. This association or "schooling" has been shown by various investigators to be primarily a visual response. However, an observation made while counting the spawning run of rainbow trout (*Salmo kamloops* Jordan) at Paul Creek near Kamloops, British Columbia, seems to indicate that vision plays a minor role in its influence on the spawning migration. The mature trout migrate into Paul Creek from Paul Lake in the month of May. The fence and trap used for enumeration is located about a hundred yards from the lake and the fish always ascend this section very rapidly, once they have entered the creek. For the purpose of counting them, each fish is lifted from the trap and released in the stream above, the sex is noted and a scale sample is taken. On May 13, 1933, attention was drawn to a ripe male because of the ease with which it was caught with the dip-net. On looking down from above, its eyes showed a bulging or exophthalmic condition; it was examined more closely and both eyes were found to have white opaque lenses. When released in the stream, it quickly oriented itself facing the current. The dip-net could be placed immediately in front of it without causing alarm, and it was easily captured three times before it moved away upstream. Normal fish show a similar reaction to the current but always dart away when approached with the dip-net. This fish was No. 277 in a total run of 806, indicating a normal position in the sequence of the run. It was four years old and displayed marked erosion at the periphery of its scales, which may have been due to having spawned the previous year, or to its feeding powers having been restricted by blindness. Whatever the cause of its blindness, this fish clearly showed its ability to undertake the spawning migration in the normal manner. The act of locating the creek and ascending it must have been prompted by some sensory response other than sight.—C. MCC. MOTTLEY, *Pacific Biological Station, Nanaimo, British Columbia.*

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[1]Craigie, E. Horne. A preliminary experiment upon the relation of the olfactory sense to the migration of the sockeye salmon. Proc. and Trans. R. Soc. Can., Ottawa, sect. V, ser 3, 1926: 20.

REVIEWS AND COMMENTS

REPTILES AND AMPHIBIANS, THEIR HABITS AND ADAPTATIONS.—By Thomas Barbour. Houghton Mifflin Company. Boston, 1934, xxii+129 pp. Second Edition. $4.00. The new edition of this book is especially welcome, for there is no better introduction to the study of reptiles and amphibians in English to be recommended to the beginner or the general reader. No other popular book on reptiles assembles so many important and interesting facts, and illustrates them with so unique a collection of photographs and drawings. Here are to be found descriptions and illustrations of the largest and the smallest salamanders, frogs, and lizards; an account of the origin and evolution of the poison apparatus in snakes; of the changes in body form which are correlated with arboreal, aquatic, and subterranean habits; and of the extraordinary breeding habits of salamanders and frogs, in which parental care of the eggs or young present some of the high lights of natural history. The large number of correlations between structure and function assembled in this book form an important contribution to the current discussion of this extraordinarily interesting evolutionary problem. Dr. Barbour's fundamental interest in systematic zoology, essentially in the whole world-wide scope of variation of the reptile and amphibian groups, is reflected in this book. It may be recommended especially to the legion of teachers of biology and nature study to extend a text-book knowledge of two of the most interesting groups of vertebrates. Changes in the new edition are corrections of minor errors in the first, and additions to the bibliography.—KARL P. SCHMIDT, *Field Museum of Natural History, Chicago, Illinois.*

ADDITIONAL PARTS OF BERG'S MONOGRAPHS ON RUSSIAN FISHES.—During 1933 there appeared additional parts, one concluding and one continuing the monographs on Russian fishes by Prof. Leo S. Berg.

LES POISSONS DES EAUX DOUCES DE L'URSS ET DES PAYS LIMITROPHES.—3-e edition, revue et augmentée. Partie II. By L. S. Berg. Leningrad, 1933: 547–903, fig. 475–762, 1 col. pl. In Russian.—A review of Part 1 of this valuable book is given in COPEIA, 1933 (3); 154. The second and concluding part appeared late in 1933. It treats 20 families: Cobitidae, Siluridae, Bagridae, Sizoridae, Anguillidae, Umbridae, Esocidae, Ophiocephalidae, Mugilidae, Serranidae, Percidae, Eleotridae, Gobiidae, Cottidae, Cottocomephoridae, Comephoridae, Gasterosteidae, Pleuronectidae, Symbranchidae and Syngnathidae. The subject is treated in the same way as in the first part, and the second part has the same qualifications. It is accompanied by a table of geographical distribution of fishes of eastern Europe and northern Asia by river basins, a chapter containing discussion of the division of the territory into zoogeographical regions, a very comprehensive bibliography, "additions and corrections," alphabetical indexes of Latin and Russian names of fishes, and a map in colors, showing zoogeographical regions for freshwater fishes, with the explanation in French. The zoogeographical discussion is supplementary to the author's *"Übersicht der Verbreitung der Süszwasserfisches Europas* (Zoogeographica, 1, 1932; 107–208, fig. 1–16, pl. 2).

FAUNE DE L'URSS ET DES PAYS LIMITROPHES POISSONS MARSIPOBRANCHII ET PISCES, Vol. 3. By L. S. Berg. Ostariophysi Livraison 3. Leningrad, 1933: 705–846, 140–172. In Russian.—This section concludes Vol. 3, which treats the Ostariophysi of the USSR; livraison 1 appeared in 1912, and number 2 in 1914. The initial volume was published in 1911, but the second volume, which will presumably treat the salmonoid and clupeoid fishes, has apparently not been published.—N. A. BORODIN, *Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.*

EDITORIAL NOTES AND NEWS

Summary of the 1934 Meeting

THE seventeenth annual meeting of the AMERICAN SOCIETY OF ICHTHYOLOGISTS AND HERPETOLOGISTS was held at the American Museum of Natural History, New York City, from Thursday, May 10, to Saturday, May 12, 1934.

Sessions of May 10

THE opening session was called to order by President NOBLE at 9:50 A.M. in the Academy Room of the Museum. There were 24 members present when the session opened, but the attendance rapidly increased and averaged over fifty for most of the sessions. The following papers were read and discussed:

1. **Notes on Herpetological Procedure**—E. R. Dunn.
2. **The Osteology of Some American Hylidae**—Charles F. Walker.
3. **The Affinities of Dicamptodon and Rhyacotriton**—T. H. Eaton.
4. **Nesting Habits of the Salamander Hemidactylium scutatum**—Frank N. Blanchard.
5. **Notes on the Life History of Ambystoma texanum**—Charles F. Walker.
6. **Physiography and Herpetology in the Lesser Antilles**—E. R. Dunn.
7. **The Ecology of Barro Colorado Island Frogs**—M. Graham Netting.
8. **Vocal Performance of Some Elusive Hylidae**—Francis Harper.

The session adjourned at 12:30, and the members joined those of the American Society of Mammalogists at luncheon in the Flying Bird Hall of the Museum. The afternoon session was called to order at 2:45 with Vice-President GORDON in the chair. The following papers were read and discussed:

9. **Lamprey Studies: (1) Revision of the Genus Ichthyomyzon; (2) Breeding Habits of Lampetra lamottenii; (3) The Multiple Origin of Non-parasitic Types; (4) The Macrophthalmia Stage in Holarctic Lampreys; The Shrinkage of Lampreys after Metamorphosis**—Carl L. Hubbs and Milton B. Trautman.
10. **A Possible Method of Evolution of Oral Brooding Habits in the Cichlid Fishes**—George S. Myers.
11. **The Taxonomic Importance of the Mobile Upper Jaw in Teleosts**—T. H. Eaton.
12. **Pressure and Temperature as Limiting Factors in the Distribution of Marine Fishes**—Dugald E. S. Brown.
13. **Pseudo-melanosis in the Tail of Trout and Salmon**—Ross F. Nigrelli.
14. **Remarks on the Genus Agkistrodon**—Clifford H. Pope.
15. **Some information about the Collections of Fishes in the Museum of Comparative Zoology**—N. A. Borodin (Communicated by E. W. Gudger).
16. **Form and Position of Suprascapula, Owen (Posttemporal Parker)—an Important Taxonomic Character for the Fishes of Lutianidae Family**—N. A. Borodin (Communicated by E. W. Gudger).
17. **Notes on Young Caranx**—J. T. Nichols.

The joint annual dinner of the two societies was held at 7 P.M. in the Birds of the World Hall of the American Museum. Following the dinner, excellent motion pictures were shown in the Hall to the members of both societies, following which, the two organizations separated in order to attend two separate programs. DR. NOBLE, DR. GUDGER, and MR. HASSLER presented very interesting motion pictures to the members of our Society at this time.

Sessions of May 11

PRESIDENT NOBLE opened the session at 9:00 A.M. The following papers were read and discussed:

18. **Ambicoloration and Allied Deformities in Flounders**—E. W. Gudger.
19. **The Earliest Gnathostomes**—D. M. S. Watson.
20. **Thirty Years of Natural Selection in Platyfishes of Mexico**—Myron Gordon.
21. **Progress Report on the Mollienisia Experiments: Hybridization, Speciation, Parthenogenesis and Sex Determination**—Carl L. Hubbs and Laura C. Hubbs.
22. **Genetics of Xiphophorine Fishes and Their Hybrids**—Myron Gordon.
23. **Chromosome Numbers in Xiphophorine Fishes**—Bernard Friedman and Myron Gordon.
24. **The Systematic Value of the Lateral Line Structures of the Head in the Percid Fishes**—Mott Dwight Cannon.
25. **The Gills of Amia calva Specialized for Respiration in an Oxygen Deficient Habitat**—Gerritt Bevelander.
26. **A Transition Zone Theory of Deep Sea and Shore Fishes**—Frank E. Firth.
27. **Application of "Williston's Law" to the Study of the Skull of Fishes**—William K. Gregory.
28. **The Anatomy of Mola mola**—William K. Gregory and H. C. Raven.

At the close of the session, the members again joined the Mammalogists in the Flying Bird Hall.

Business Meeting

PRESIDENT NOBLE called the annual business meeting to order at 1:40 with 23 members, of whom 9 were Governors, in attendance. With the consent of the Society, the SECRETARY omitted the reading of the minutes of the 1933 meeting, which had already been published in "COPEIA," in order to save time.

The SECRETARY reported that 38 new members were obtained during the year, 16 members resigned, and 22 were dropped for non-payment of dues. Thus, the new members added to the rolls exactly balanced those lost and the Society ended the year with 350 members. Similarly, 4 new subscribers were obtained and 4 institutions were forced to cancel their subscriptions so that the total number of subscribers remained at 69. A geographical analysis of the members and subscribers indicated that 76 copies of "COPEIA" go to 21 foreign countries, with Canada leading with 19, and England, Germany, Japan and the U.S.S.R. following with 6 each. Three hundred forty-three copies go to 38 states and the District of Columbia, with New York State leading with 63, California following with 44, Michigan with 24, Massachusetts and the District of Columbia with 23 each and Pennsylvania with 20. In conclusion, the SECRETARY encouraged the members to make an attempt to place "COPEIA" in as many libraries as possible and to endeavor to secure new members for the Society.

The report of the TREASURER covering the period from May 6, 1933, to May 5, 1934, was read by MR. HENN, and approved. Receipts for this period were $2601.50, distributed as follows: Cash balance, May 6, 1933, $623.23; annual dues, $885.50; annual subscriptions, $208.30; contributions (mainly to the 20th Anniversary Number), $506.14; sale of reprints, $237.60; sale of back numbers, $112.77; miscellaneous, $27.96. Expenditures during the same period amounted to $1678.40, allocated as follows: publication of "COPEIA" (four numbers), $1306.18; cost of reprints, $231.61; photostats of back numbers, $38.50; postage, $50.21; miscellaneous printing, $49.30; miscellaneous, $2.10. The balance as of May 5, 1934 was $923.10 and the only outstanding obligation was the bill for the printing of the April number of "COPEIA."

DR. HUBBS made a few remarks in lieu of a formal EDITOR'S report. There were no reports from Standing Committees. President NOBLE appointed DR. E. R. DUNN to the Standing Committee on Nomenclature. The SECRETARY announced that as the meeting place for 1935 had been definitely voted upon at the previous meeting, and as the Mammalogists had taken similar action at their present meeting, both societies were scheduled to meet in Pittsburgh in May 1935. The Nominating Committee offered the following officers for the ensuing year and the report of this committee was unanimously accepted: LEONHARD STEJNEGER and JOHN T. NICHOLS, *Honorary Presidents*; CARL L. HUBBS, *President*; E. W. GUDGER, FRANCIS HARPER, and CLIFFORD POPE, *Vice-Presidents*; M. GRAHAM NETTING, *Secretary*; A. W. HENN, *Treasurer*; CARL L. HUBBS and HELEN T. GAIGE, *Editors*. DR. GUDGER moved that in the future each speaker on the program be limited to fifteen minutes with the chairman empowered to ring a warning bell at the end of ten minutes and to force the speaker to discontinue at the end of fifteen minutes. After considerable discussion, this motion was voted down, but it was suggested that the matter be considered by the Local Committee for the 1935 meeting. The 38 new members of the Society, acquired during the year, were duly elected. The meeting adjourned at 2.20.

Following the adjournment of the business meeting, the remaining papers were read and discussed:

29. **The Indexed Card Catalogue Continuing the Bibliography of Fishes**—E. W. Gudger.
30. **Remarks on Galapagos Turtle Colonies**—C. H. Townsend.
31. **A Hermaphroditic Snake**—Clifford H. Pope.
32. **Notes on Chameleons**—Carl F. Kaffeld.
33. **On the Origin of the Hood Pattern of the Indian Cobra**—Charles W. Dawson and Clifford H. Pope.
34. **An Experiment on the Food of Turtles**—Leo T. Murray.
35. **An Experimental Study of the Life History of Sceloporus undulatus**—G. K. Noble, W. G. Hassler and G. Lipsey.
36. **Aggregation Responses and Trailing Reactions of Storeria dekayi and Other Snakes, with Especial Reference to the Sense Organs Involved**—G. K. Noble and H. J. Clausen.
37. **Courtship of the Garter Snakes**—Herbert Ruckes.
38. **The Role of the Sense Organs in the Courtship of Snakes**—G. K. Noble.

The formal reading of papers was concluded at 4:40 and the members adjourned to the Laboratory of Experimental Biology to see a series of interesting demonstrations and to inspect this magnificent biological laboratory.

At 8:15 the members of both Societies were the guests of DR. CHARLES H. TOWNSEND, and of the New York Aquarium, at a Smoker at the Aquarium. The excellent refreshments and the fine opportunity for informal discussion combined to produce a most delightful evening.

Meeting May 12

DURING the morning some of the members visited the Laboratory of Vertebrate Paleontology at the American Museum to see DR. BROWN'S exhibit of Recent Discoveries of Fossil Reptiles. The members of both societies met at the New York Zoological Park at 1:00 P.M. where they were most hospitably entertained at a luncheon in the Rocking Stone Restaurant as the guests of the Zoological Society. They were also afforded an opportunity to see three giant lizards, which had just arrived at the Park after a long trip from Komodo Island. The meetings of both societies terminated at this time, although a large proportion of the members spent the afternoon in the Park.

Prior to the close of the meeting the Committee on Resolutions, E. R. DUNN and MILTON B. TRAUTMAN, presented the following resolution which was unanimously accepted and heartily endorsed by all the members in attendance; *Resolved,* That the American Society of Ichthyologists and Herpetologists expresses its appreciation of, and thanks for the hospitality and entertainment provided for its members by the Local Committee, the American Museum of Natural History, the New York Aquarium, and the New York Zoological Society.

Meeting of Western Division

THE Western Division of the Society of Ichthyologists and Herpetologists held its sixth annual meeting in conjunction with the Pacific Division of the American Association for the Advancement of Science at Berkeley, California, on June 20. The 47 members present showed keen interest in the 15 papers which were presented.

A collection of live western lizards and reptiles collected by Sherwin F. Wood was on exhibition.

The following papers were presented:

1. **Notes on the Sexual Behavior and Embryos of Some Western Lizards.** Sherwin F. Wood.
2. **Trout Diseases in California.** Joseph H. Wales.
3. **The Spadefoot Toad in Nevada.** Jean M. Linsdale.
4. **Studies of the Mechanism of Color Changes in Fishes.** F. B. Sumner.
5. **The Formation of the Rattle in the Rattlesnake.** L. M. Klauber.
6. **The Speed of Locomotion in Snakes.** Walter Mosauer.
7. **The Fishes of Utah Lake.** Vasco M. Tanner.
8. **The Tongue-worms (Linguatulidae) Internal Parasites of Reptiles.** Howard R. Hill.
9. **Notes on the Western Spotted Frog, Rana pretiosa.** Arthur Svihla.
10. **Postlarval Stages in the Life History of the Pacific Flatfish Microstomus pacificus.** Lawrence D. Townsend.
11. **Some Observations on the Growth Rate of the Western Fence Lizard.** Henry S. Fitch.
12. **Some Observations on Ambystoma gracile.** James R. Slater.
13. **Some Principles of Fish Taxonomy.** Rolf L. Bolin.
14. **Food Habits of Skull Valley Lizards.** G. F. Knowlton and W. L. Thomas.
15. **The Amphibians and Reptiles of the Olympic Mountains of Washington.** P. G. Putnam.

The following were elected officers for the coming year: President, L. M. KLAUBER, San Diego Museum of Natural History; Vice-President, L. M. SCHULTZ, University of Washington; Secretary-Treasurer, ARTHUR SVIHLA, State College of Washington.

Back Numbers of Copeia

J. T. NICHOLS, founder of this journal, has recently donated to the Society all of the remaining stock of the numbers of COPEIA which were issued by him. Large supplies of these back numbers had already been turned over. This very generous gift not only gives the Society the opportunity of filling sets, but also provides an additional source of revenue for the enlargement of the journal. Members are urged to complete their files while this is possible, and to request libraries with which they may be associated to do likewise. A revised price-list for back numbers and sets is available.

A Plea to The Older Herpetologists

THE following communication, which seems to the editors to be timely, has been received from one of the members of the Society who desires to remain anonymous.

Sometimes you, as a teacher of biology, or curator of a museum collection, will have working under your guidance some promising young student of herpetology. He will be monographing a genus or studying the variations of a group.

With your sanction and by the use of your letterhead and through your personal acquaintance with fellow herpetologists, he will borrow material from far and wide throughout the country, from university collections, from museums and from private owners. The museum, when transmitting its material to this student for examination and return, really has you in mind, for the young student is to them unknown. It is your letterhead or your personal intercession which has secured the loan; therefore, it should be your responsibility to see that the material receives proper care. Thus, it is your responsibility to instruct the student in the precautions which must be taken if the material is not to be depreciated beyond what is normally expected in packing and transportation. This much you owe to the lending museum in exchange for granting the favor of the loan to your research worker. The beginner may have little realization of the cost of these specimens in time and labor—the arduous and often fruitless work in the field, the tiresome routine of the preparator in the laboratory. But you, with your experience, have knowledge of the value of these specimens, and the difficulty or impossibility of replacing those damaged or destroyed.

A few gentle reminders and "don'ts" will be well received from you by the student working under your direction, whereas from the distant museum they would appear discourteous. You ought first of all to caution him as to care and gentleness in unpacking, the proper provision for the storage of the material while on loan, making sure that it is always adequately covered by preservative and protected from the light, except while examination is under way. Upon return the same precautions against abrasion or breakage by the use of cloth wrappings should be taken as were employed by the original transmitter. Care should be used that none of the number tags be displaced, and if some of the old fashioned paper labels still remain and become detached, they should be wrapped about the specimen and tied thereto. Some museums are careful to segregate alcoholic from formalin specimens, and an endeavor should therefore be made by the student to avoid mixing specimens subjected to these different preservatives.

The tails of lizards should receive especial care and attention. Anatomical examinations requiring extensive incisions should not be made without the consent of the owner of the material—at least beyond the determination of sex.

Last, and above all, material must be kept adequately moistened at all times, even while scale counts and color examinations are under way. If it is necessary to lay out upon the laboratory table for comparative examination a large series of specimens, they must be frequently moistened, and when the student turns aside to make notes or record his results, cloths moistened with preservatives, should be used to cover the specimens. Failing in this amphibians will be dried out beyond recognition, and snakes and lizards will shed scales and entire patches of skin, leaving exposed a gray and immature under-skin having no relation in color to the natural exterior of the creature.

When improperly cared for material returns to the original lender with broken tails, cut for examination and with skins shed so that the pattern and color are gone beyond all recognition, the lending museum has no recourse but to change its rules and thenceforth discontinue loans, to the detriment of future workers.

The new herpetology is greatly enriched by the enormous number of specimens available in our museums, as compared to the few that could be had during the pioneer days in the middle of the last century. Studies in variation are possible of which our predecessors never dreamed. But with this material there comes likewise an increased responsibility for its care, and it is the duty of the older herpetologists to bring this to the attention of the new comers as an important part of their herpetological training.

News of Herpetologists

LAST winter T. BARBOUR, as a guest on Mr. Allison V. Armour's research yacht *Utowana*, was able to make collections of reptiles at the following localities: Nassau; Eleuthra Id.; Conception Id.; Rum Cay Id.; San Salvador Id.; Clarence Harbor and South Point, Long Id.; Mathewtown and Sheep Cay, Great Inagua Id.; Mariguana Id.; Crooked Id.; Mira Por Vos Islets; Fish Cay, Acklin Id.; Hawks Nest, Cat Id.; Great Abaco Id.; Grand Bahama; Cape Haitien, Port Paix, Tortuga Id., and Vache Id., Haiti; Sanches Roads, San Lorenzo Bay, Santa Barbara, Saona Id., and Beata Id., San Domingo; and La Gonave.

On June 30 T. BARBOUR, accompanied by his family, plans to visit two of the Universities of South Africa and the Kruger National Park in the Transvaal, sailing on the steamship *Resolute*. Short stops are to be made at Trinidad and Brazilian ports and St. Helena. At Cape Town the party will leave the ship to travel overland, rejoining it about two weeks later at Loranco Marquez in Portugese East Africa. The return voyage is via East Africa and Madagascar with various stops in Egypt, Palestine, Greece, Italy and Spain. Dr. Barbour expects to be back in Boston the morning of September 19 in time for the opening of Harvard University a few days later.

Mr. A. M. STEBLER and Dr. L. C. STUART, both of the Museum of Zoology, University of Michigan, left in June for the Bad Lands and Black Hills of South Dakota, where they will spend three months collecting reptiles and mammals, and making ecological studies in the two localities.

NORMAN E. HARTWEG has been appointed Assistant Curator in the Division of Herpetology of the Museum of Zoology, University of Michigan.

News of Ichthyologists

ON May 17 the Institute of Fisheries and Fish Culture of the U.S.S.R. held a jubilee celebration honoring Prof. LEO S. BERG, on the occasion of the completion of 35 years of scientific work.

Prof. J. R. DYMOND, Associate Professor of Systematic Zoology, University of Toronto, and Assistant Director of the Royal Ontario Museum of Zoology, Toronto, has been appointed Director of the Museum succeeding the late Prof. B. A. Bensley. Prof. Dymond is especially known for his studies of Canadian freshwater fishes.

Recent Deaths

ROBERT WILSON SHUFELDT died on January 21, 1934, at the age of 83. Though better known in some other lines of natural history, Major Shufeldt also contributed to ichthyology. He was one of the pioneer fish photographers, and published a number of papers on the osteology of fishes. He also wrote many popular articles.

It is perhaps not generally known that Dr. EDWARD WILLIAM NELSON, who died on May 19 at the age of 79 years, began his long scientific career as an ichthyologist. When 21 he published *A Partial Catalogue of the Fishes of Illinois*, and as a result of work for the Fish Commission in the Chicago area published *Fisheries of Chicago and Vicinity* in 1878. With the help of Tarleton H. Bean he reported in 1887 on the fishes he had collected in Alaska from 1877 to 1881. During his long period of field service for the Biological Survey, notably in Mexico, Nelson continued to collect fishes, and also reptiles, which were studied by others. From 1916 to 1927, he served as chief of the Biological Survey. The passing on of such all-round field naturalists as Nelson leaves a vacancy, to be regretted not only because of the picturesqueness of their careers, but also because there is a vital need, still, for the services of such men.

Mr. DANIEL BACON, friend of the New York Aquarium who has made several zoological expeditions on his private yacht, with C. M. Breder, Jr., as guest naturalist, died recently.

FERNAND LATASTE, French vertebrate zoologist, died at Bordeaux, on January 6, 1934, at the age of 87.